CALIFORNIA PUBLIC UTILITIES COMMISSION

Opportunities for Green Innovation and Job Creation

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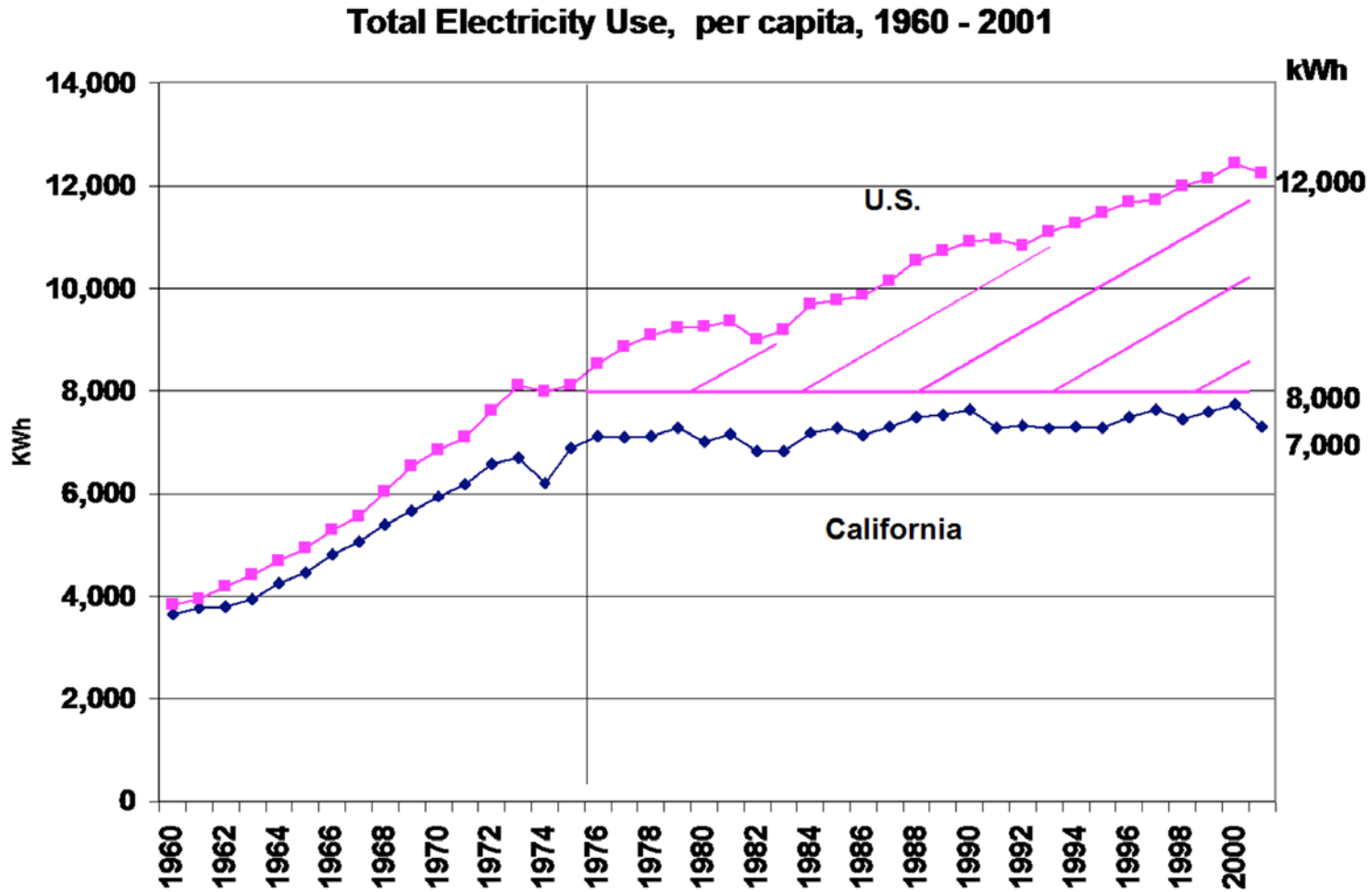
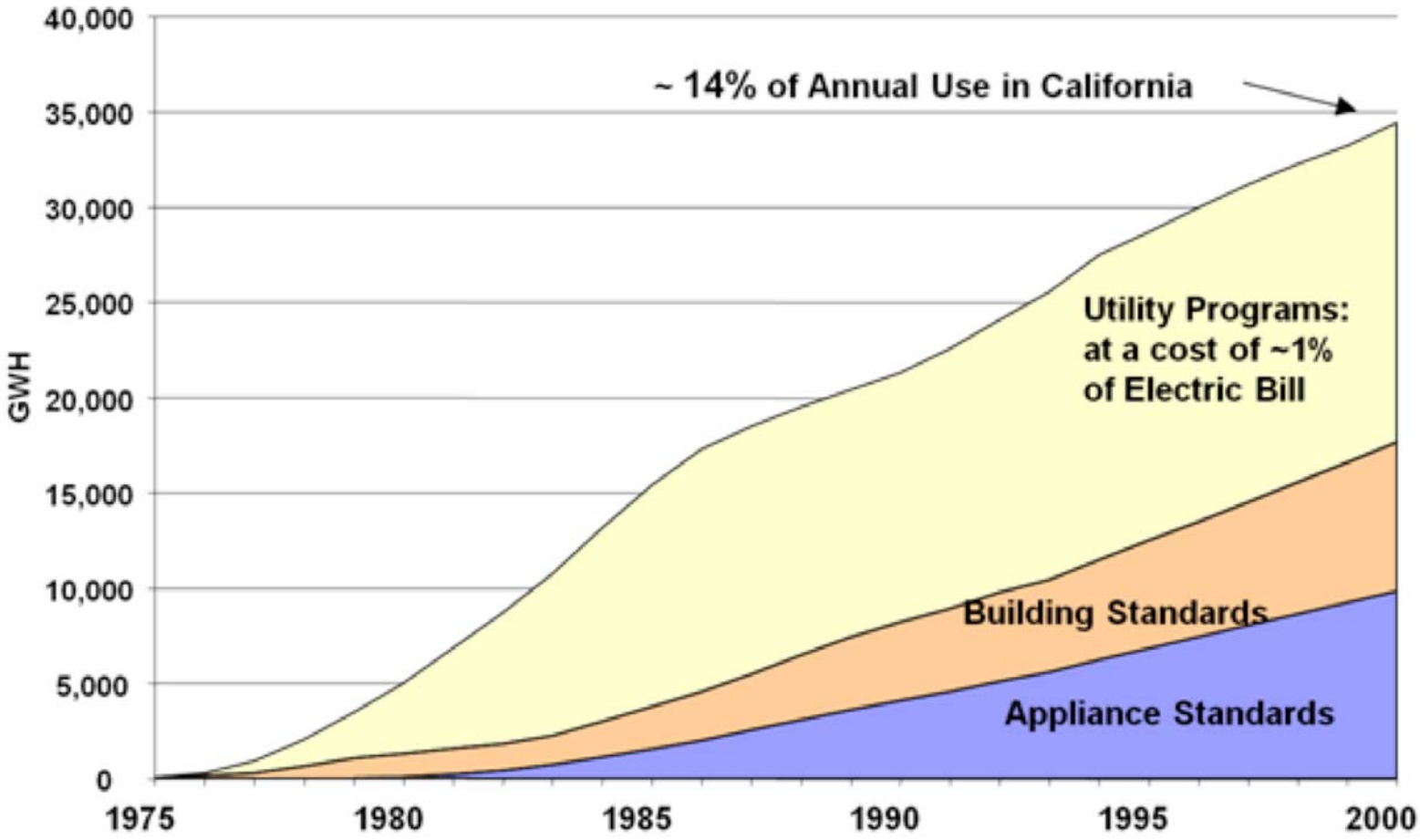
10 June 2009

Energy Efficiency and Jobs: California's Legacy



Energy Efficiency Gain Impacts from Programs Begun Prior to 2001

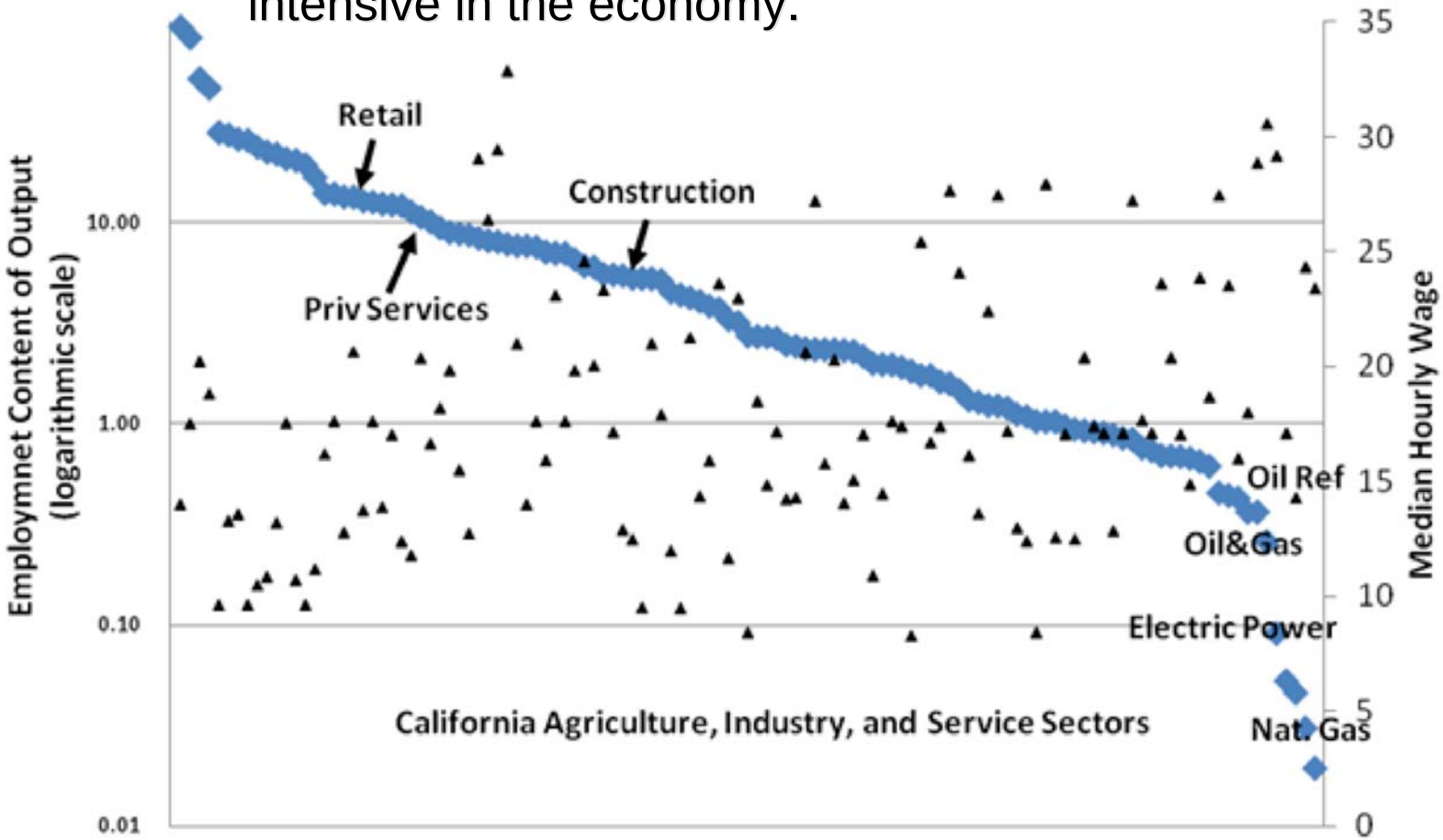


Historical Jobs Assessment

- A retrospective multiplier analysis of demand shifting
- Detailed BEA five-year Input-output Tables
- Employment data from California Employment Development Department dataset (CREE)

Why it works

The carbon fuel supply chain is among the least employment intensive in the economy.



Source: California Employment Development Department dataset.

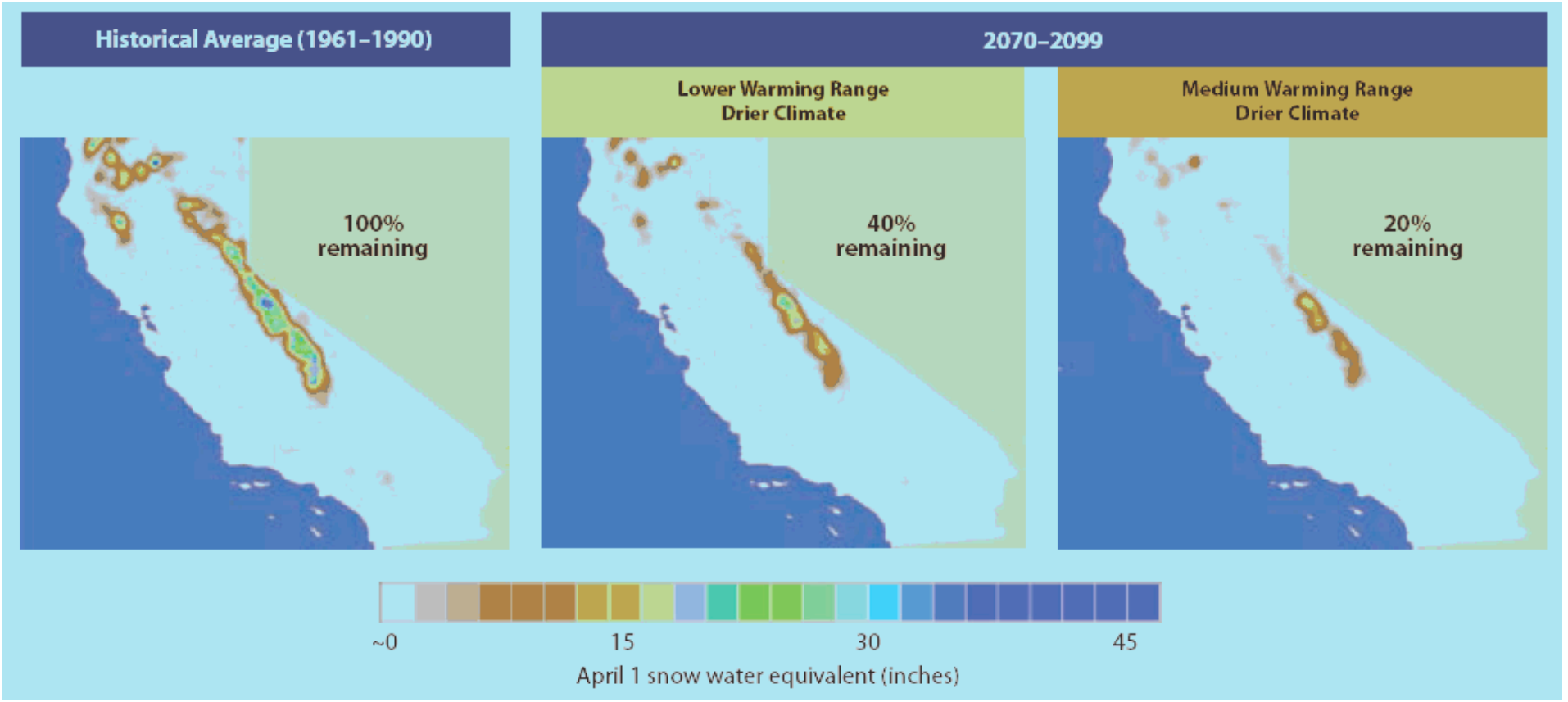
Efficiency for Growth

- Promoting efficiency saves money for individuals and enterprises, liberating resources for more job-intensive growth
- Standards and incentives should be extended nationally, using public policy to overcome adoption barriers and innovation constraints
- Energy efficiency is the next breakout technology sector, and domestic standards to promote innovation will establish global markets

Adaptation: The New Agenda of Climate Defense

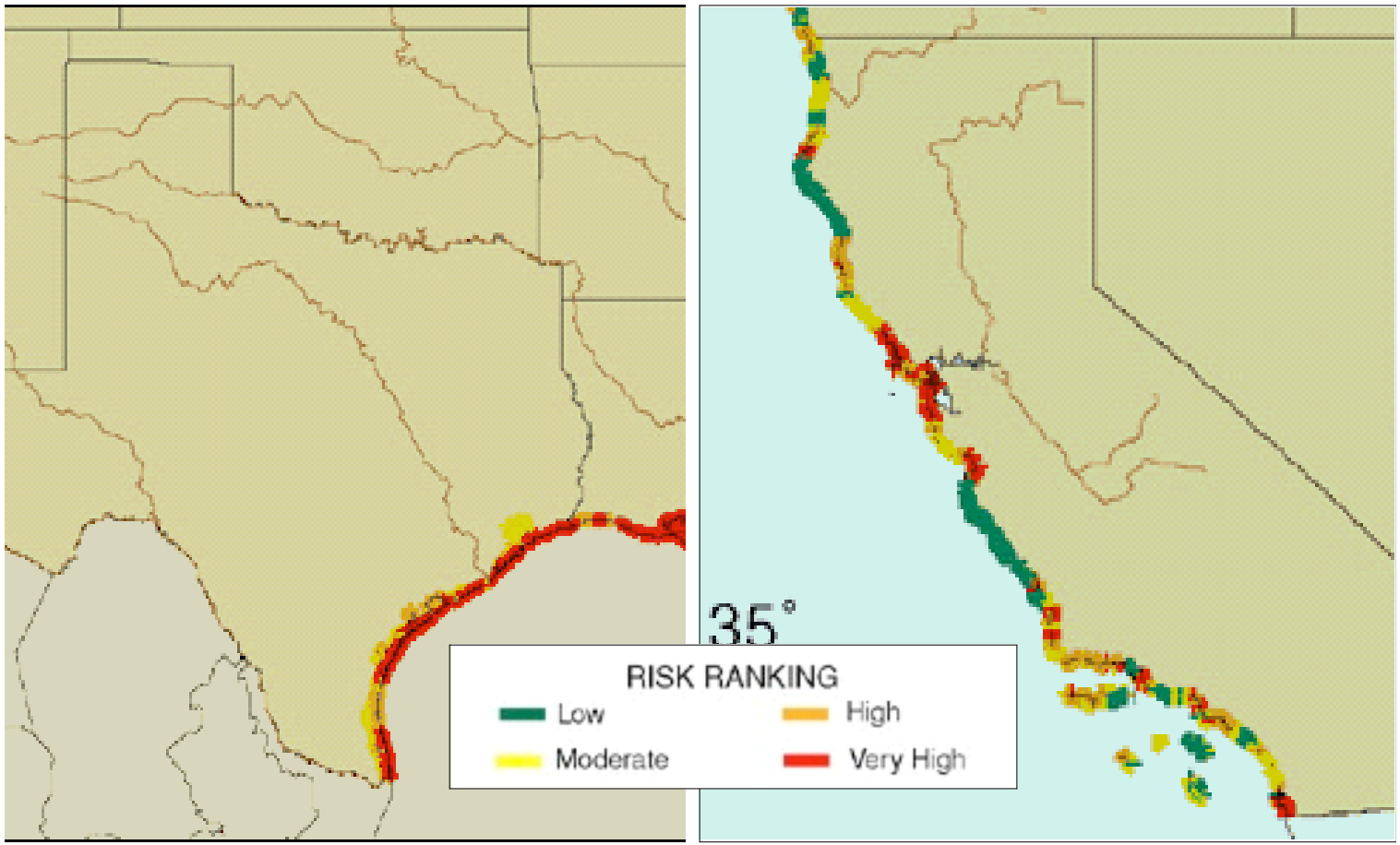
- No state or country can stop Climate Change alone, but each has a responsibility to protect itself
- Over the next century, we face enormous adaptation challenges, regardless of our own mitigation policies

Reduction in the Sierra Snowpack



Notes and Source: "Lower Warming Range Drier Climate" is based on an GFDL B1 scenario; "Medium Warming Range Drier Climate" is based on a GFDL A2 scenario. Luers et al., 2006.

Coastal Vulnerability



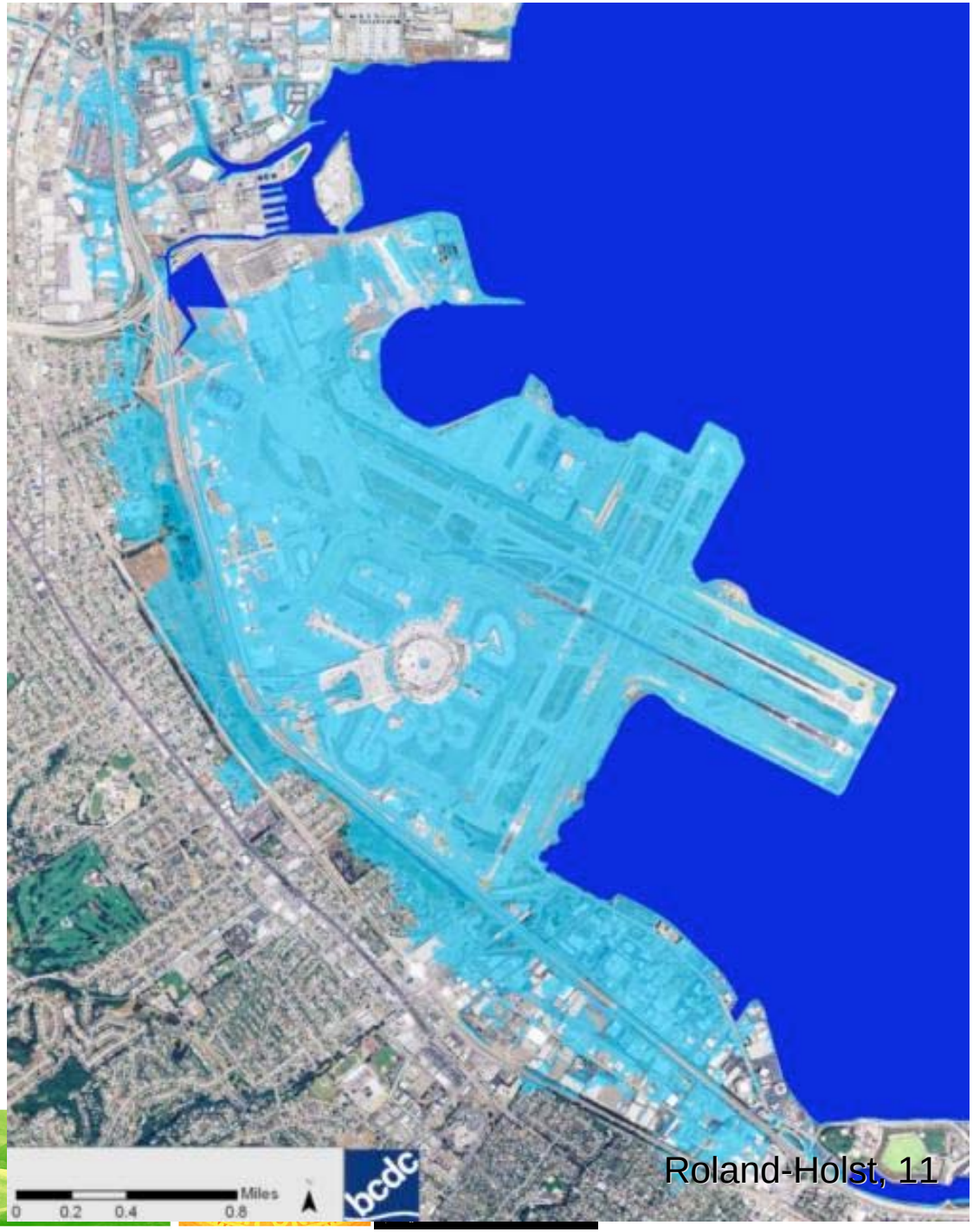
Source: Adapted from USGS Woods Hole Science Center website, http://woodshole.er.usgs.gov /project -pages/cvi/

Inundation/Salinization Risk

Source: San Francisco Bay Conservation and Development Commission

San Francisco International Airport

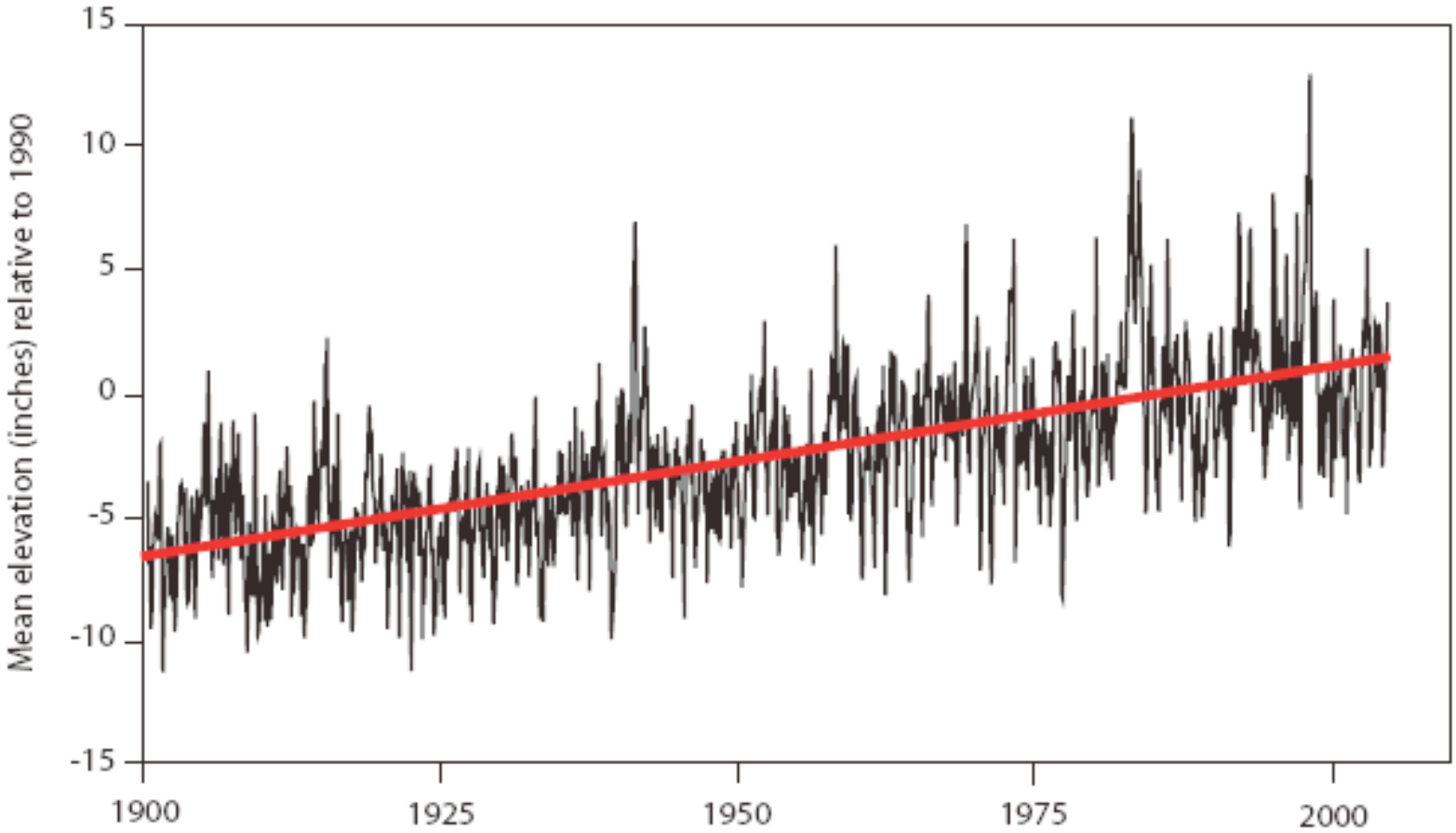
One Meter Sea Level Rise



10 June 2009

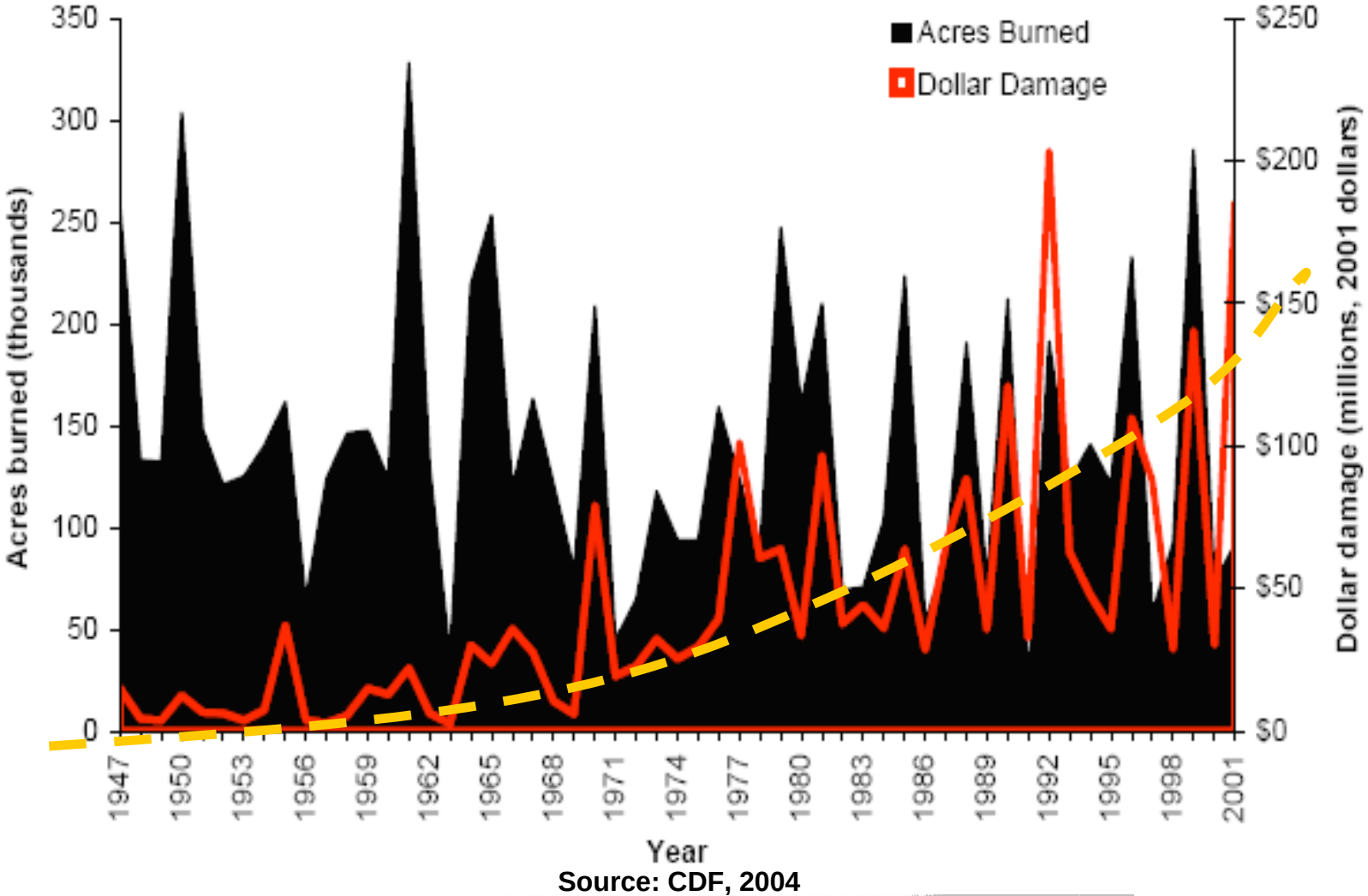
NEXT 10

San Francisco Bay Sea Level



Notes and Source: "Lower Warming Range Drier Climate" is based on an GFDL B1 scenario; "Medium Warming Range Drier Climate" is based on a GFDL A2 scenario. Luers et al., 2006.

Acres Burned and Dollar Damage



Source: CDF, 2004

Smart Stimulus: SuperGrid

Energy pathways for the Digital Age:

- Electric power has been hailed as the greatest engineering achievement of the 20th century – illuminating light bulbs
- Sustainable diffusion of universal, high resolution information will surely be that of the 21st – illuminating people
- To achieve this requires development of a new generation of Integrated Energy Infrastructure (IEI)

The Next Big Thing

- If the Federal government is looking for the next big public works commitment (after TVA, interstates, internet), IEI is it
- With its private technology leadership and forward-looking utility sector, California can define global standards for public/private partnership in energy infrastructure
- For rapid deployment of large scale public spending and job creation, this is better than picking winners in the underlying technologies (highways vs. cars, dams vs. subdivisions, internet vs. software/content)

Three Emerging Needs

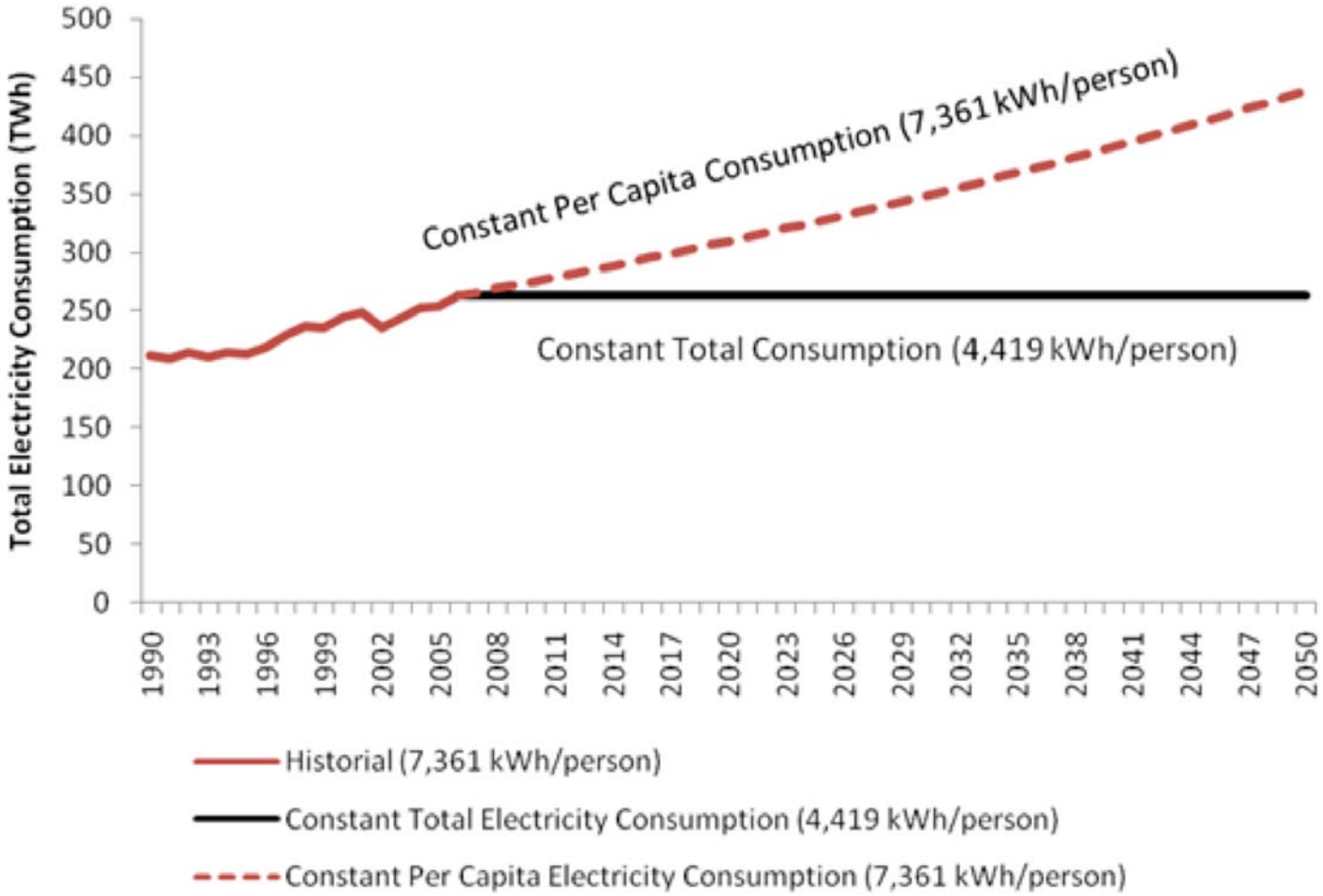
1. Residential and industrial electric power needs for a growing economy
2. Capacity to integrate extensive and diverse renewable energy sources
3. Capacity for continuous reliability and high resolution support of more extensive and intensive IT diffusion

Energy Demand Growth

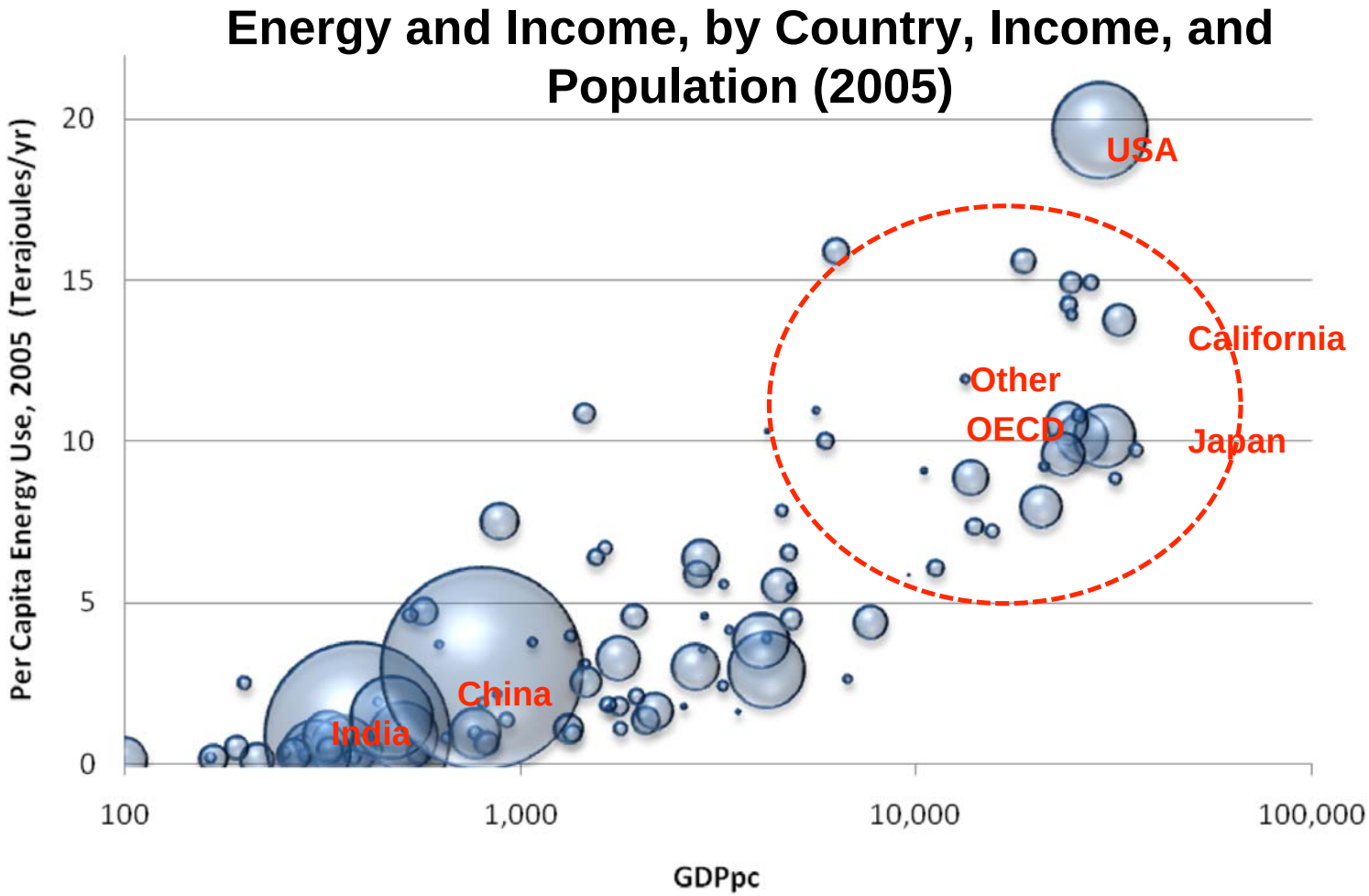
Primary drivers:

- Population/income growth
- Climate change
- Electric vehicle integration

Population to Double by 2050



Another reason why we need this…



Source: Author estimates from International Energy Agency and World Bank data. Bubble diameter is proportional to population

Renewables Integration

Two primary challenges:

1. Extensification - Geothermal and large scale solar sources are in areas outside current transmission networks
2. Storage – two of the largest renewable sources, solar and wind, are intermittent

Super-critical reliability

- Intensive digital information and media systems (ICT, finance, medical, security/defense) have critical requirements for energy continuity and resolution
- Today's grid is remarkably efficient and reliable given its sheer complexity, but it cannot meet the needs of a modern information economy.
- Power shortages and interruptions alone cost the U.S. as a whole at least $150 billion per year (DOE:2006).

Medium and Message: Energy and Information

The grid of the future will embody the essential synergy between energy and information

- Digital infrastructure is powered by electricity, but electricity infrastructure will be managed by digital technology
- The SuperGrid will be an intelligent, auto-balancing, cost minimizing, self-monitoring power network that integrates a variety of energy sources and delivers critical reliability and resolution
- It must provide the comprehensive foundation for decentralized, “smart” energy systems

Why this is Difficult -

- Most of the legacy grid was designed to support local electrification, resulting in fragmentation and inefficiency
- The grid of the future must be integrated for efficient allocation, load/cost sharing, and continuous technology diffusion and reliability
- Big Push - To make this work and trigger the necessary private agency will require a commitment device: huge initial investment and exercise of property rights

Why it is Worth It -

- Early harvest of employment-intensive infrastructure development
- Strong complementarities across an energy triangle of utilities-technology-endusers to facilitate adoption and innovation
- Long term benefits for sustainability and knowledge-intensive, higher wage economic growth

Conclusions

1. The supposed tradeoff between environment and economic growth is a fallacy, and in California we have proven this.
2. Energy efficiency is a potent catalyst for job creation, not just in boutique technology sectors, but across the economy.
3. We face substantial risks from climate change, but Climate Defense offers a new agenda for economic stimulus and growth that is employment, technology, and skill intensive
4. One of the most important commitments in this context is to develop a statewide SuperGrid, a flagship infrastructure project that integrates all electric power sources and uses for knowledge-intensive economic development

CALIFORNIA'S GREEN ECONOMY

California Public Utilities Commission

Thought Leaders Series June 10, 2009

Tracey Grose
Collaborative Economics

OVERVIEW

1. RESOURCE EFFICIENCY AS ECONOMIC STIMULUS
2. THE EMERGING GREEN ECONOMY: OBSERVATIONS SO FAR
3. THE ROLE OF GREEN INNOVATION
4. REAL OPPORTUNITIES FOR POLICY MAKERS

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1. RESOURCE EFFICIENCY AS ECONOMIC STIMULUS

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IMPROVING ENERGY AND RESOURCE EFFICIENCY

BENEFITS:

- Cost-savings to consumers
- Competitive advantage
- Creation of new markets and jobs

DRIVERS:

- Public policy: new standards and incentives
- Buffer from recession & volatile fuel costs
- Growing concern about global climate change

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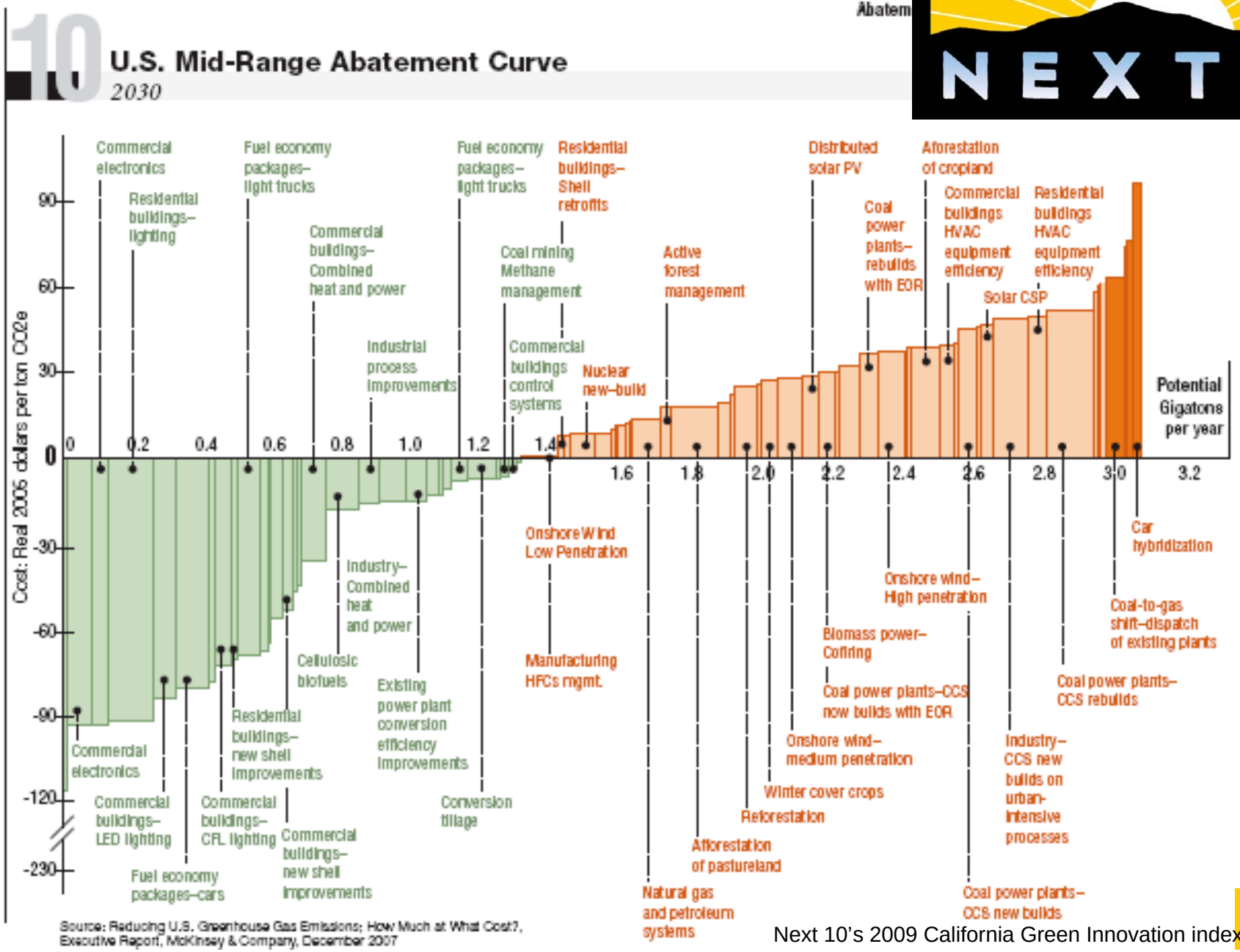
REAL SAVINGS RESUL T



Source: Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?, Executive Report, McKinsey & Company, December 2007

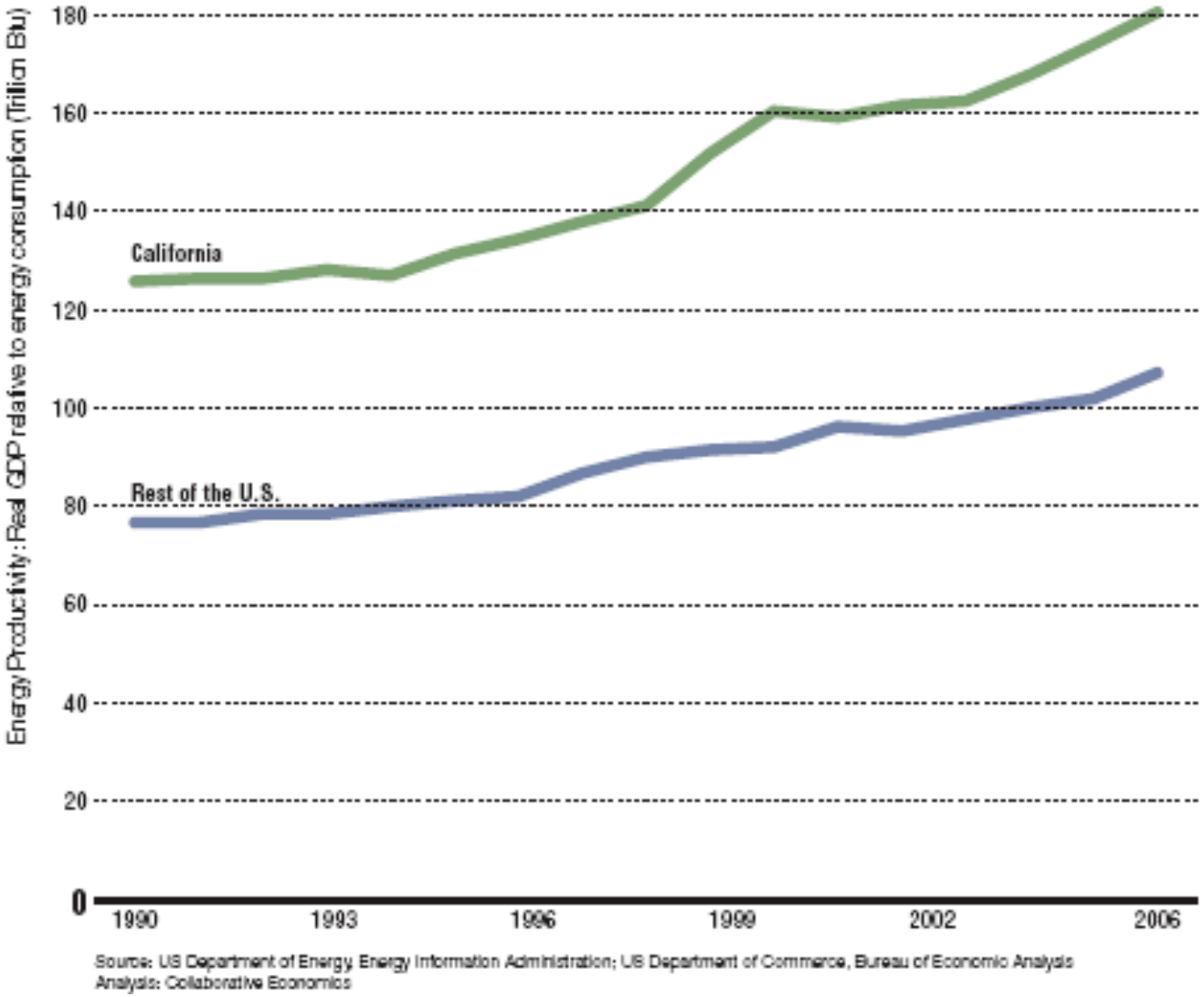
WIDTH= Abatement potential (CO2e per year)

HEIGHT= Average cost of avoiding 1 ton of CO2e

LEFT SIDE= Positive returns on investment

RIGHT SIDE= Progressively higher cost-

…FOR AN ECONOMY AS WELL



Source: US Department of Energy, Energy Information Administration; US Department of Commerce, Bureau of Economic Analysis
Analysis: Collaborative Economics

California's energy productivity, GDP relative to total energy consumption, is **68% higher** than the U.S.

Growth in energy productivity = more $ of GDP per unit of energy consumed.

2. THE EMERGING GREEN ECONONY: OBSERVATIONS SO FAR

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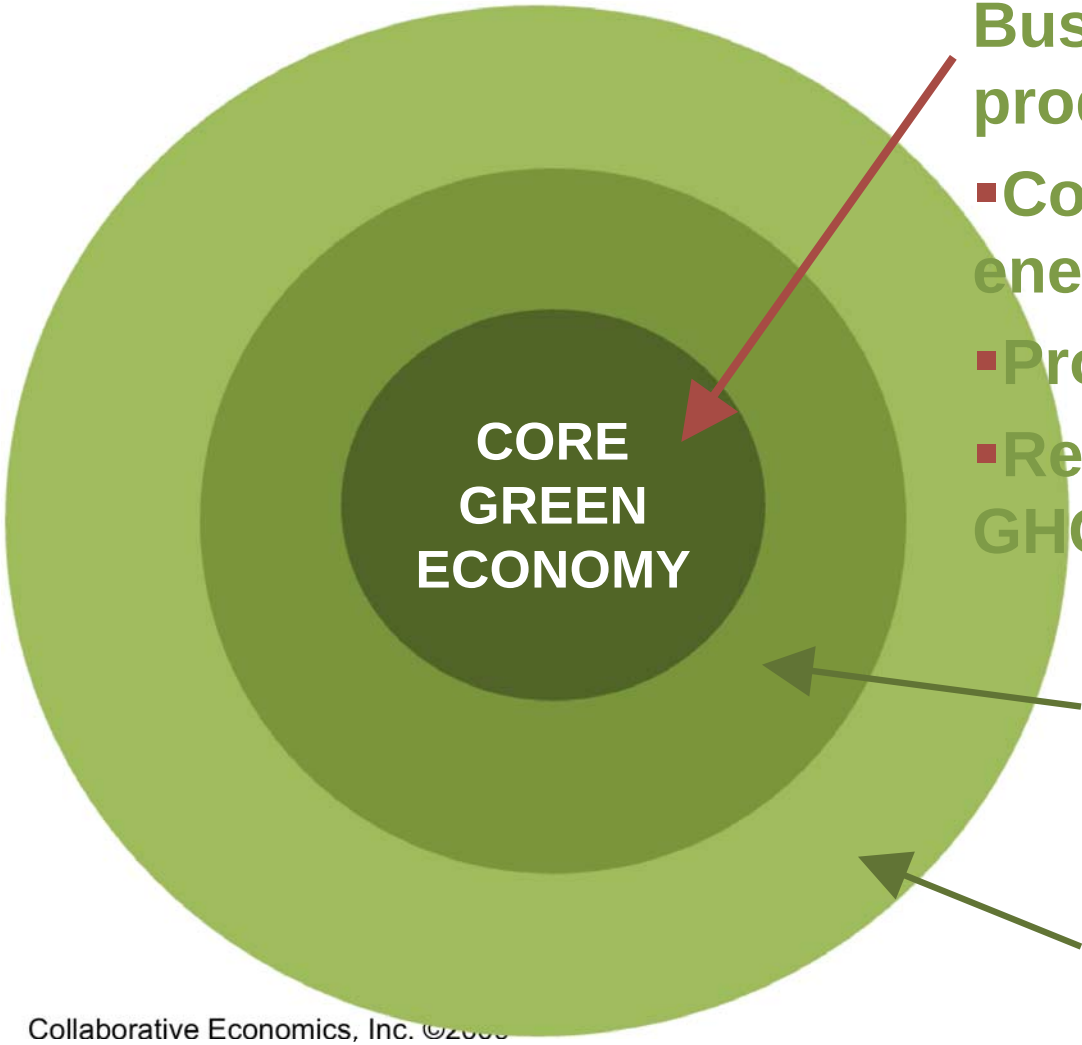
THE GREEN ECONOMY IN LAYERS



Businesses providing products & services that:

- **Conserve natural and energy resources**
- **Provide clean alternatives**
- **Reduce pollution (e.g. GHG emissions)**

Businesses founded with sustainability at core

Businesses "greening" products, production processes & supply chains

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DRIVING THE GREEN ECONOMY

Important dynamics emerge between different roles that drive the green economy. These include:

- Public Policy Makers
- Research Scientists
- Entrepreneurs
- Financiers
- End Users

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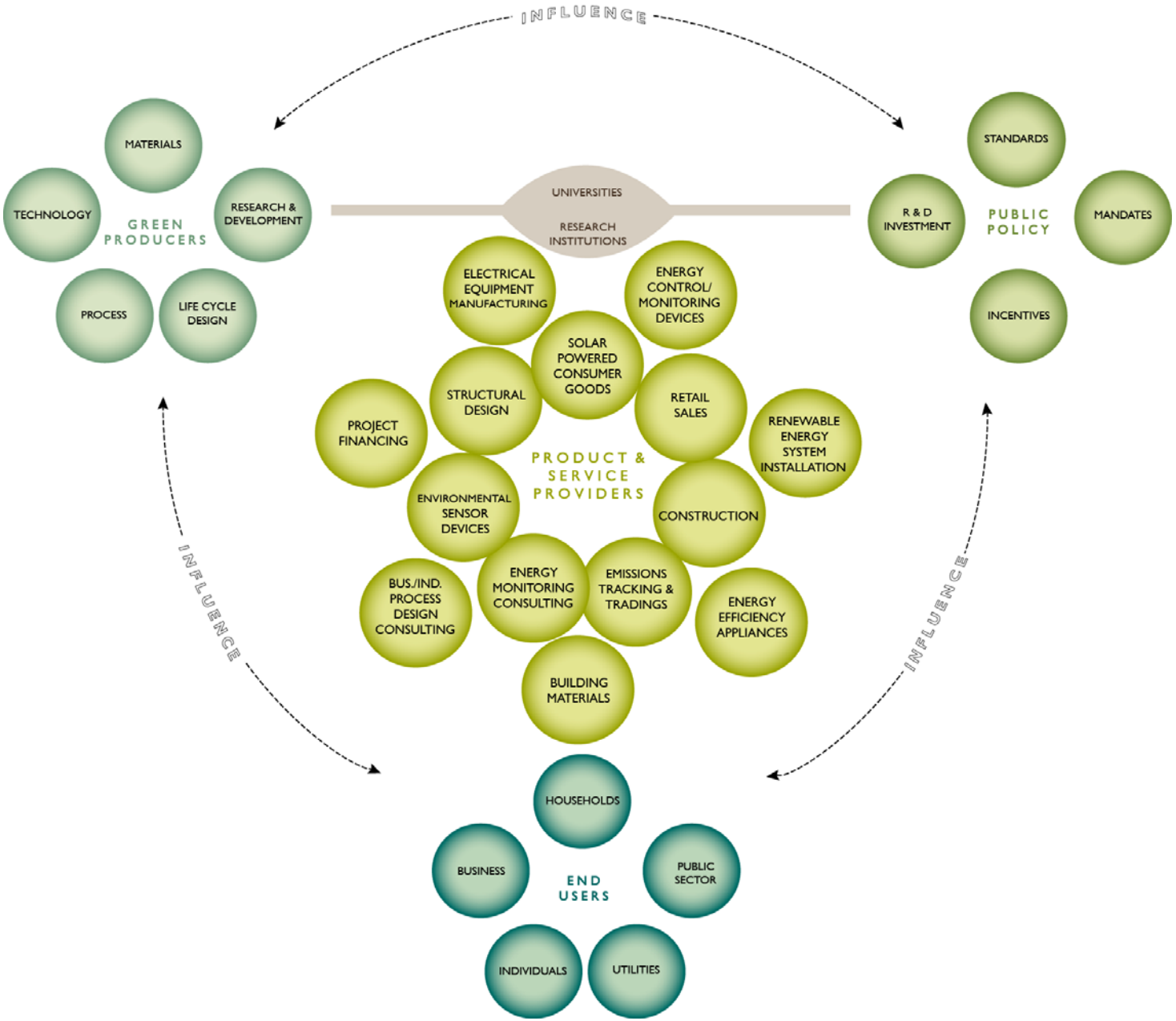
CALIFORNIA GREEN ECONOMY VALUE NETWORK



OBSERVATIONS

- **Diversity** - There is a wider range of green activities than commonly appreciated by segment and across the supply chain
- **Specialization** - Each state has different specializations
- **Industry Adaptation & Differentiation** - Much of green activity builds on existing industry strengths and extends them into new markets
- **Green jobs are growing** at a faster rate than the whole economy
- **Green Innovation** is taking place in most states

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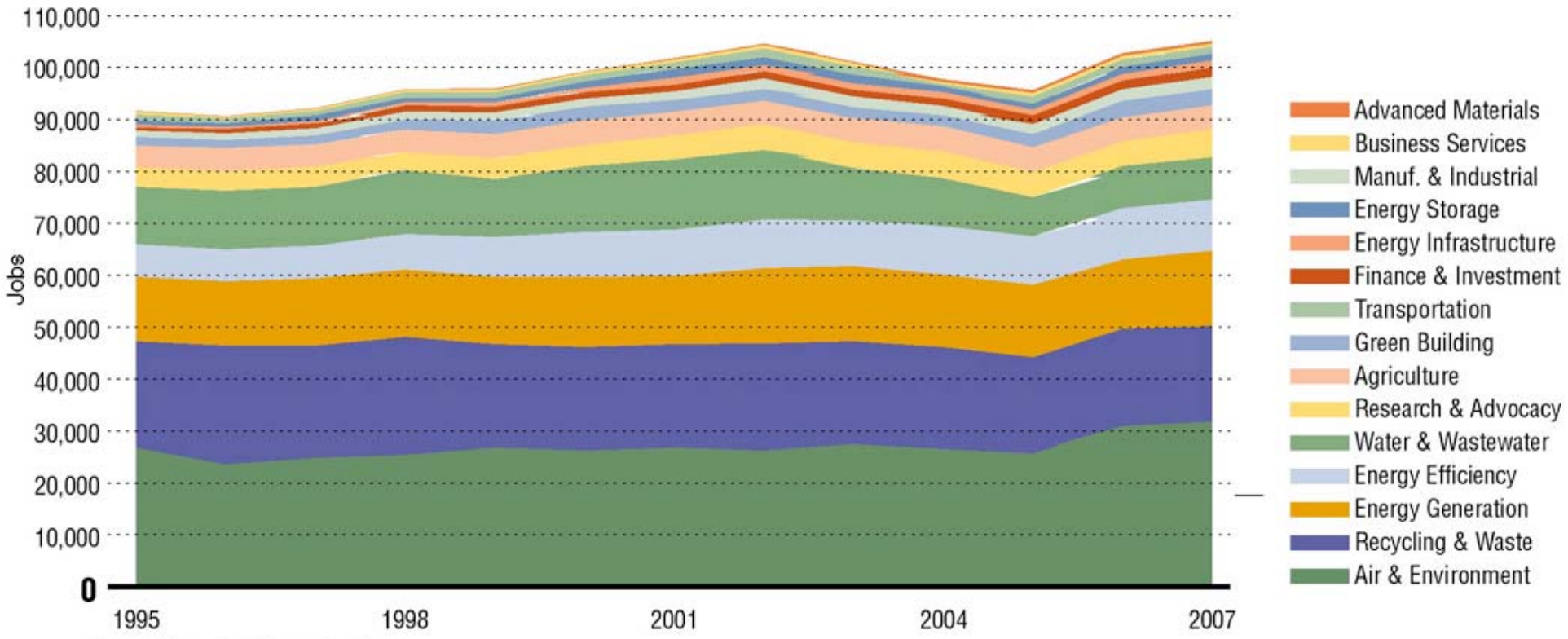
CORE GREEN ECONOMY IS DIVERSE

CALIFORNIA GREEN JOBS



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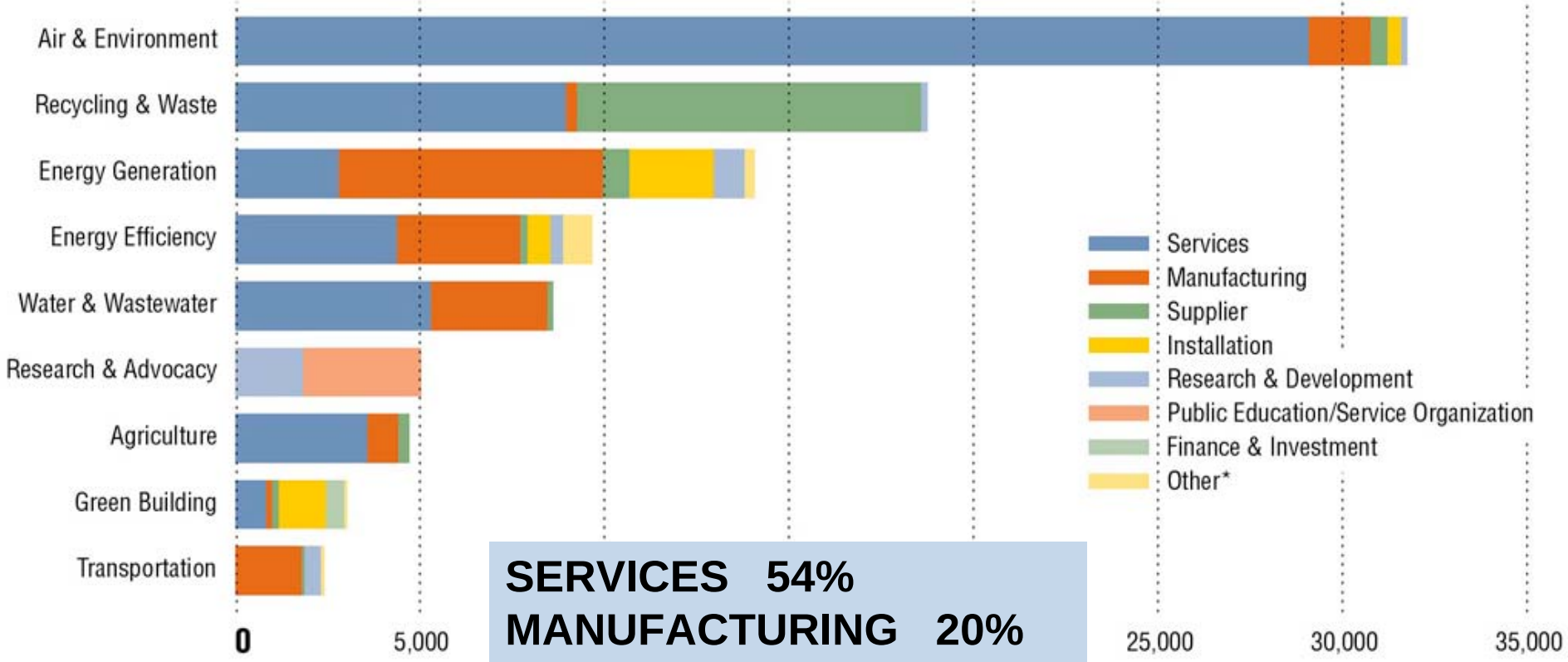
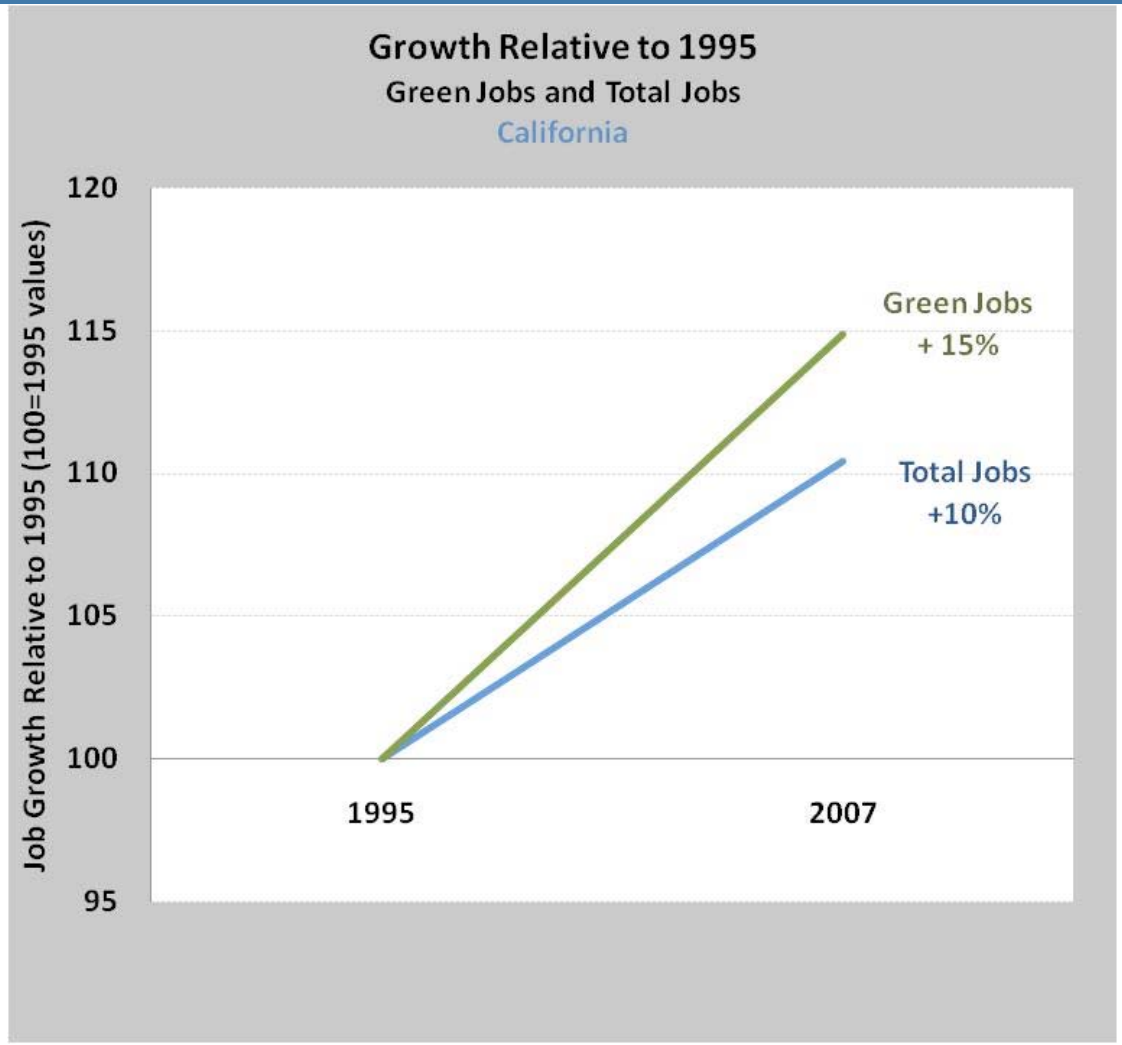
GREEN JOBS ARE DIVERSE

CA GREEN JOBS BY ESTABLISHMENT TYPE



SERVICES 54%
MANUFACTURING 20%
R&D 4%

GROWTH IN GREEN JOBS OUTPACES TOTAL JOBS



In California, 1995 to 2007, jobs in green businesses grew 15% while total jobs grew only 10%.

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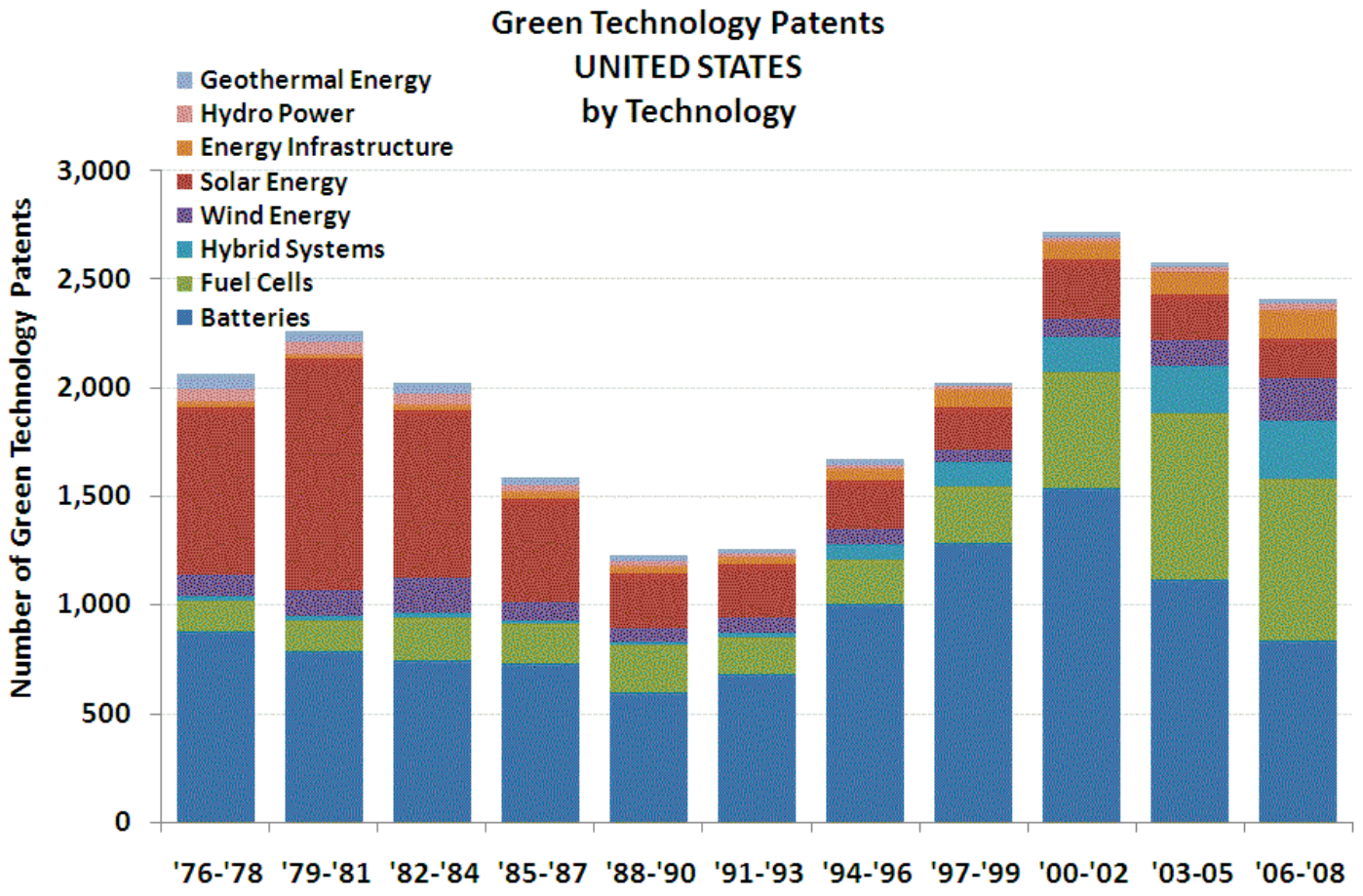
3. INNOVATION IS KEY:

INVENTION & INVESTMENT

WAVES OF INVENTION BY GREEN TECHNOLOGY



Data Source: 1790 Analytics, Patents by Technology; USPTO Patent File
Analysis: Collaborative Economics

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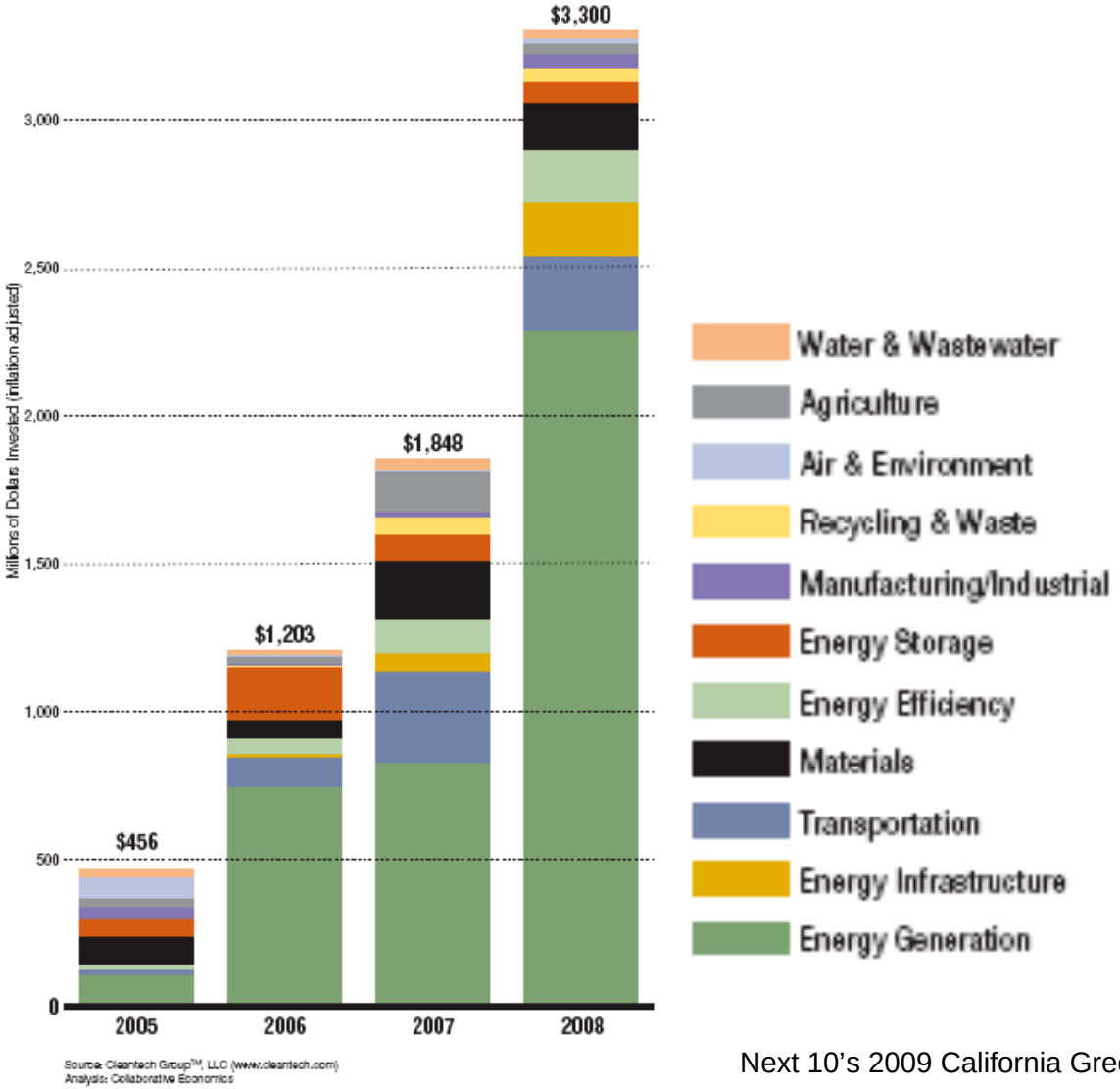
CALIFORNIA IS LEADER

Total Green Tech Patents Top Ranking States in Patents Registered	# of Patents Registered	Ranking	
	2002–07	2002–07	1990–1995
California	**607**	**1**	**1**
New York	539	2	7
Michigan	444	3	7
Connecticut	273	4	10
Massachusetts	174	5	3
Ohio	143	6	2
Texas	126	7	12
New Jersey	118	8	6
Illinois	100	9	11
Pennsylvania	100	9	5

- **2002-2007 Patents**
- **#1 SOLAR: 148**
- **#1 BATTERY: 203**
- **#3 HYBRID SYSTEM: 31**
- **#3 FUEL CELL: 164**
- **#1 WIND: 61**

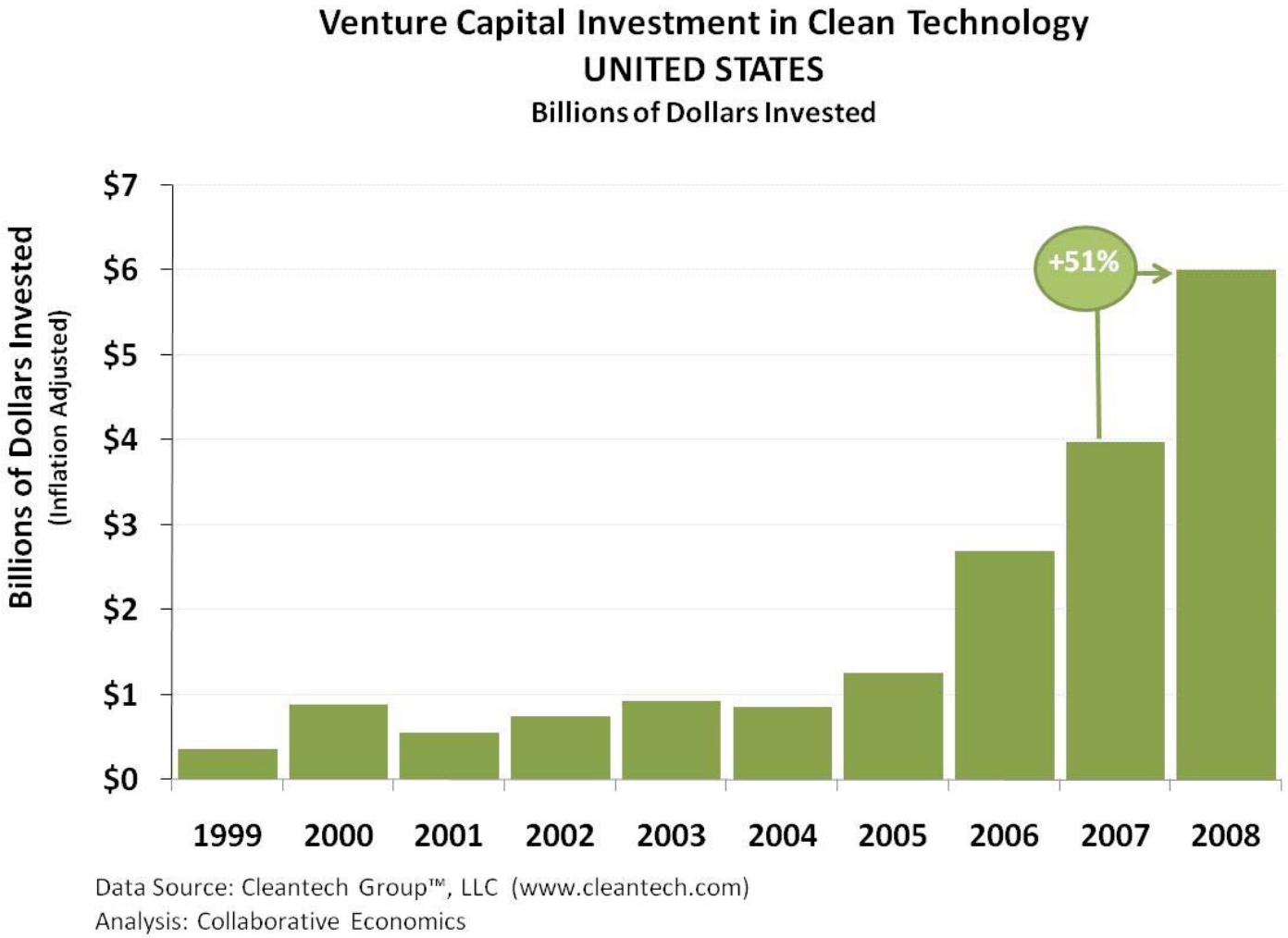
CALIFORNIA ALSO LEADS THE NATION IN VC INVESTMENT



California attracted 57% of total U.S. cleantech VC investment in 2008 totaling $3.3 billion.

69% was in Energy Generation.

PRIVATE INVESTMENT HAS BEEN DRIVER BUT IS SLOWING IN 2009



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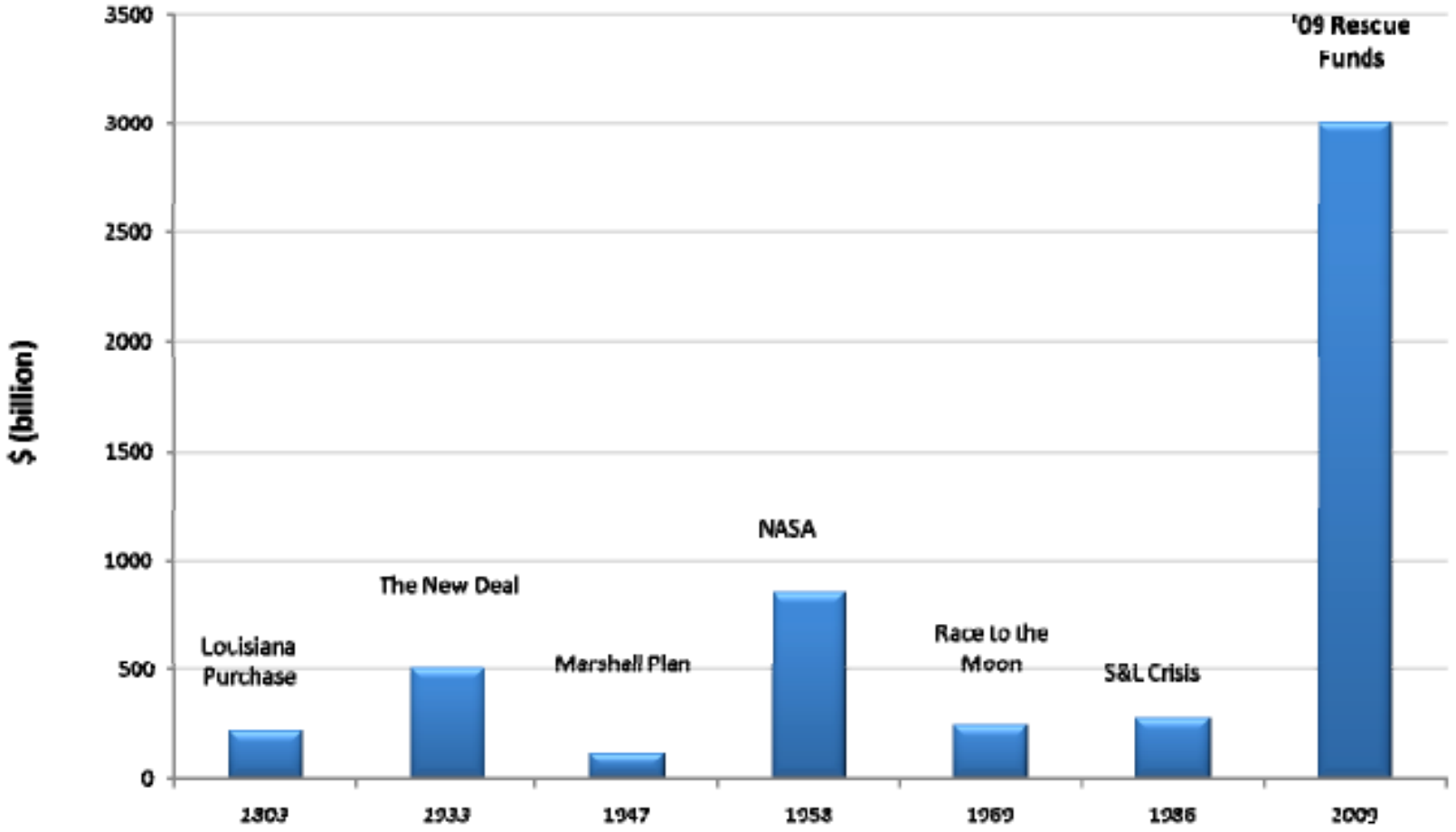
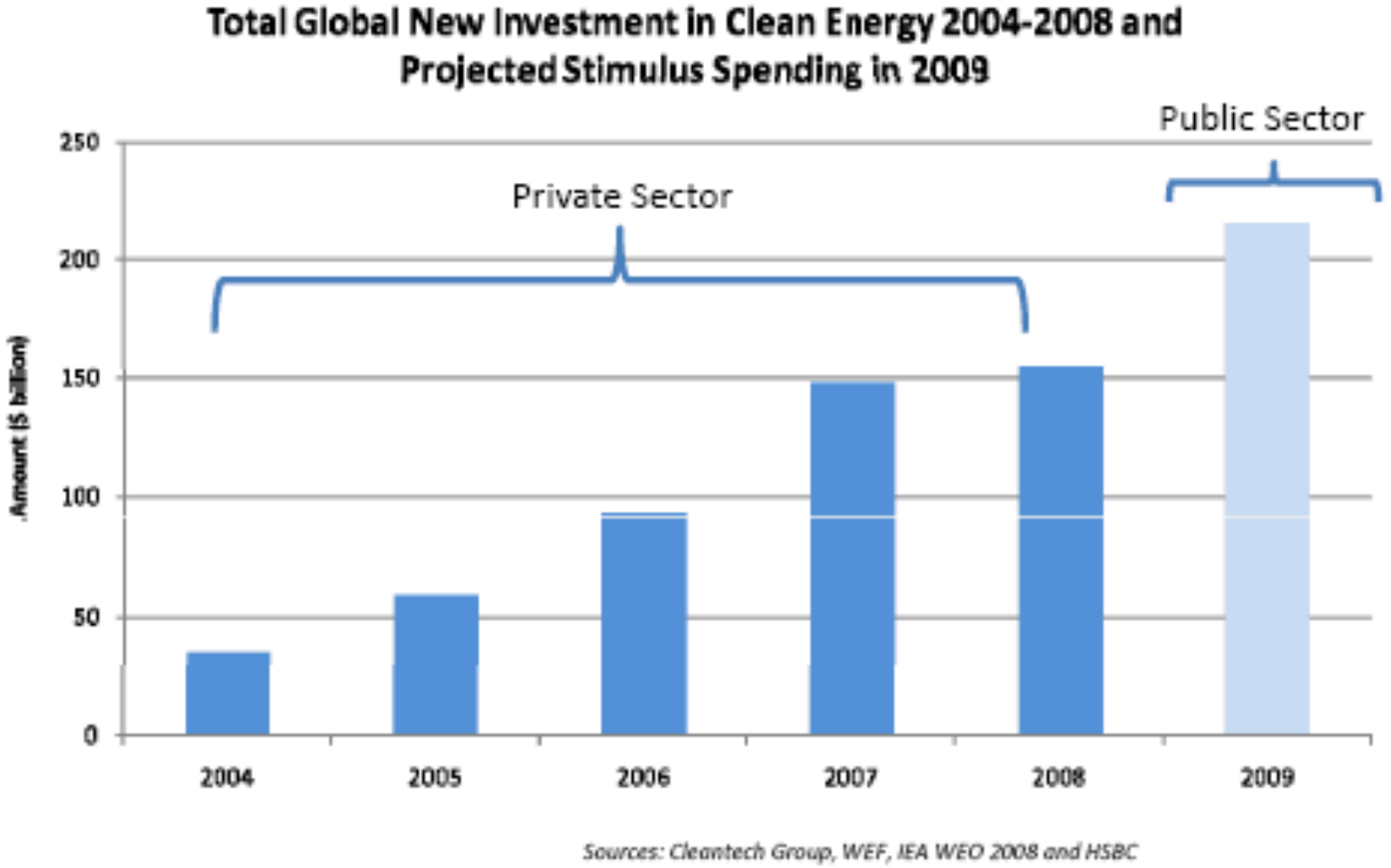
GOVERNMENT SPENDING: THE LARGEST PROJECTS IN HISTORY



Compiled from numerous sources by Intel Corporation

Deloitte. cleantech GROUP LLC

PUBLIC SPENDING COULD HELP FILL CURRENT GAP IN PRIVATE FUNDING



Sources: Cleantech Group, WEF, IEA WEO 2008 and HSBC

Deloitte. cleantech GROUP LLC

4. REAL OPPORTUNIES FOR PUBLIC POLICY MAKERS

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POLICY MAKERS CAN HAVE REAL IMPACT

- Realigning Incentives:
  - Utility Revenue Decoupling
- Growing Green Markets
  - Standards and Incentives
  - Streamlined Permitting
- Negotiating Investment and Aligning Resources

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CALIFORNIA PUBLIC UTILITIES COMMISSION

California's Green Economy

F. Noel Perry, Founder, Next 10

June 10, 2009

About Next 10

- Founded in 2003
- Independent, Nonpartisan, Nonprofit
- Focus: Budget, Infrastructure, Green Economy
- Commissions expert research to educate, engage and empower Californians
- Website: www.next10.org

Budget Challenge

Expert Research

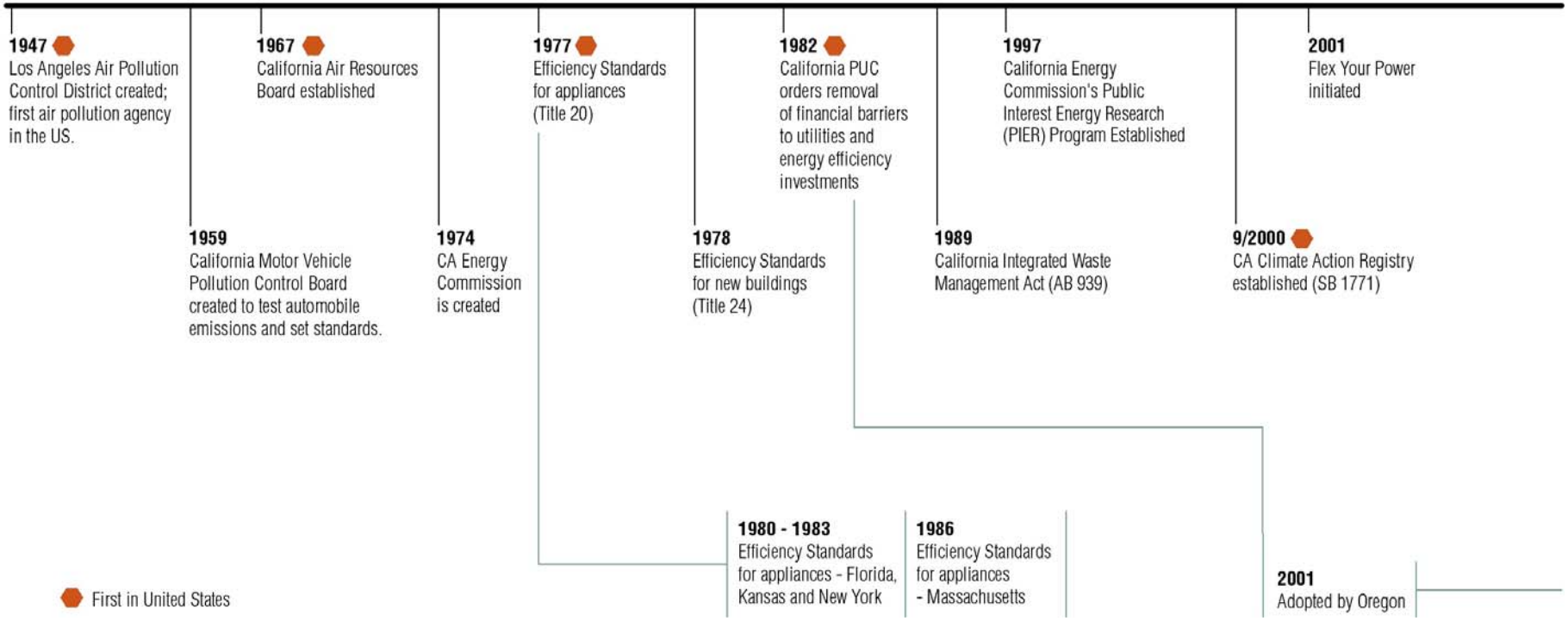
CoolCalifornia.org

Index Senior Advisors

Ralph	Cavanagh	Natural Resources Defense Council
Michael	Hanemann	CA Climate Change Center, UC Berkeley
Hal	Harvey	The William & Flora Hewlett Foundation
Elliot	Hoffman	New Voice of Business
Van	Jones	Ella Baker Center
Dan	Kammen	Renewable & App. Energy Lab, UC Berkeley
Bruce	Klafter	Applied Materials
Joel	Makower	Executive Editor, GreenBiz.com
Jason	Mark	The Energy Foundation
Walter	McGuire	McGuire & Co., Inc./ Flex Your Power
Joe	Nation	Former State Assemblyman, District 6
Manuel	Pastor	Professor of US Studies & Ethnicity, USC
Fran	Pavley	Assemblymember (2000-2006), Author AB 32
Wendy	Pulling	Pacific Gas & Electric Company
Carol	Whiteside	Great Valley Center
Tim	Woodward	Nth Power

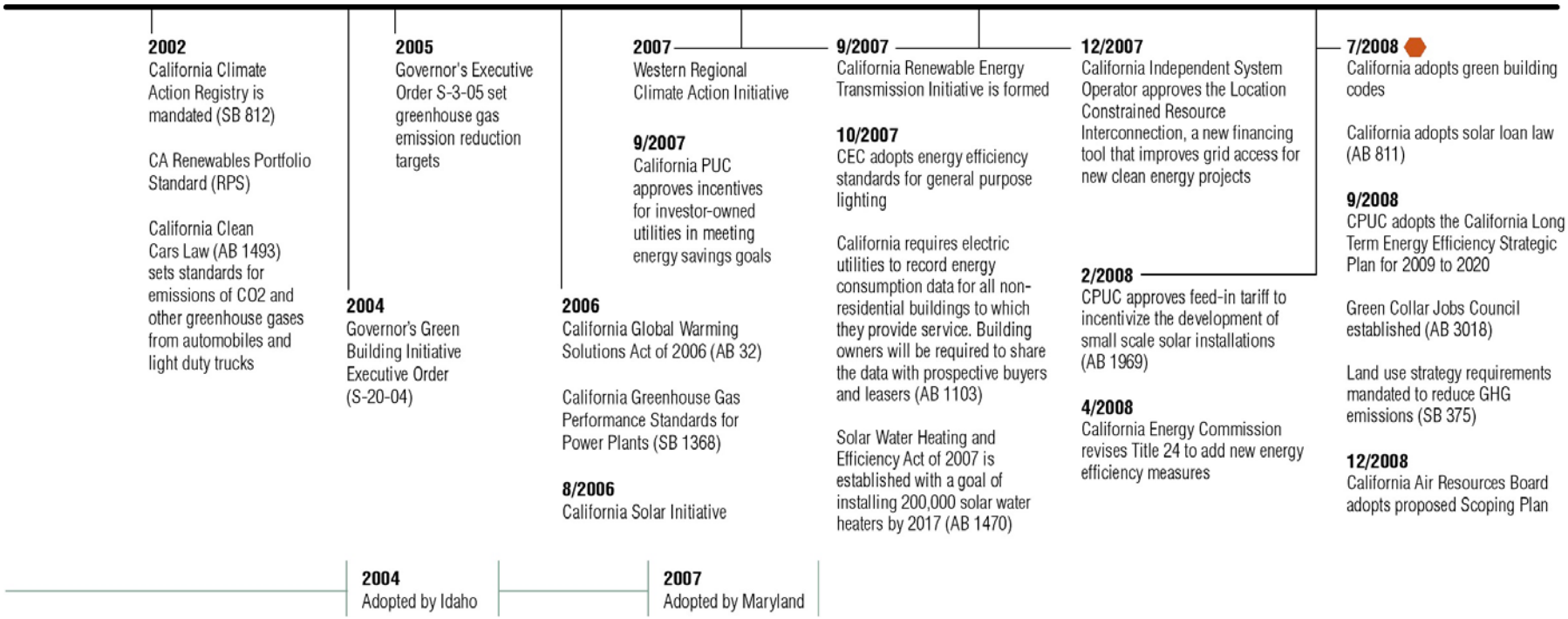
POLICY INNOVATIONS: 1947-2001

California Policy Innovations Over Time (Regulatory, Investment, Incentives)

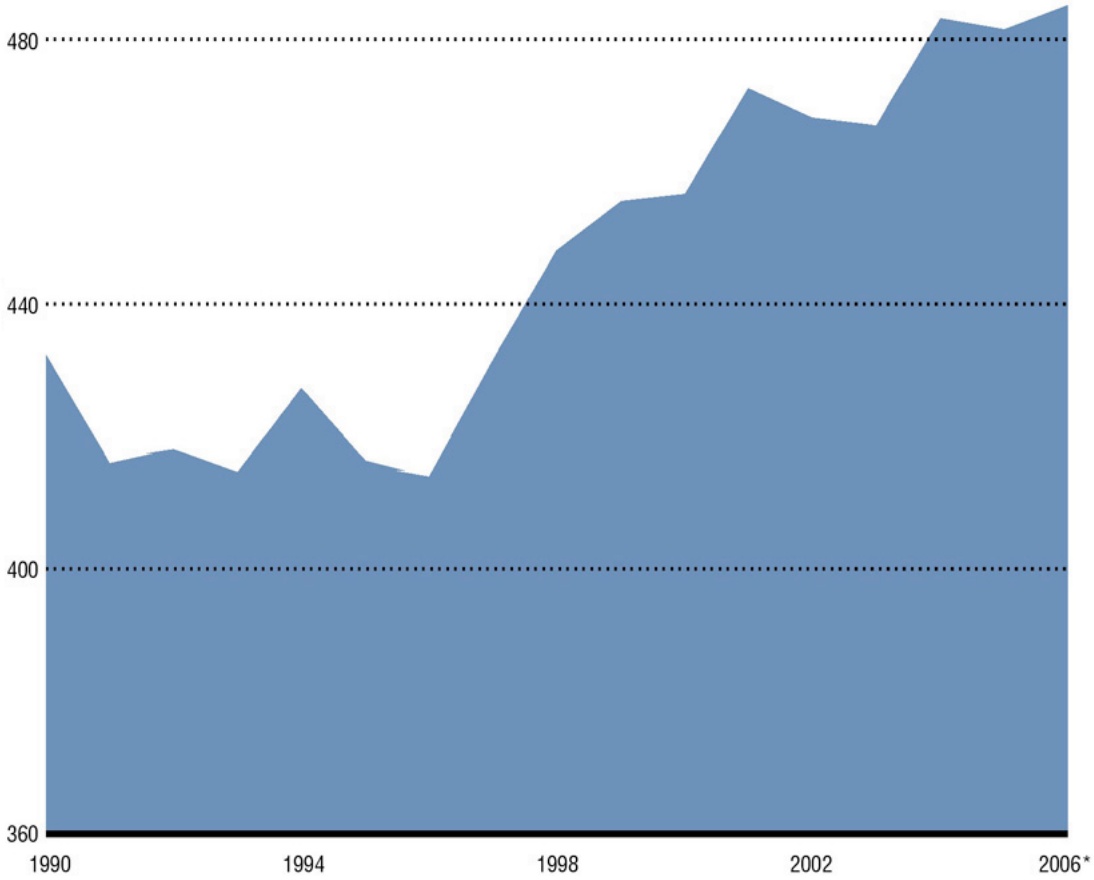


POLICY INNOVATIONS: 2002-2008

California Policy Innovations Over Time (Regulatory, Investment, Incentives)

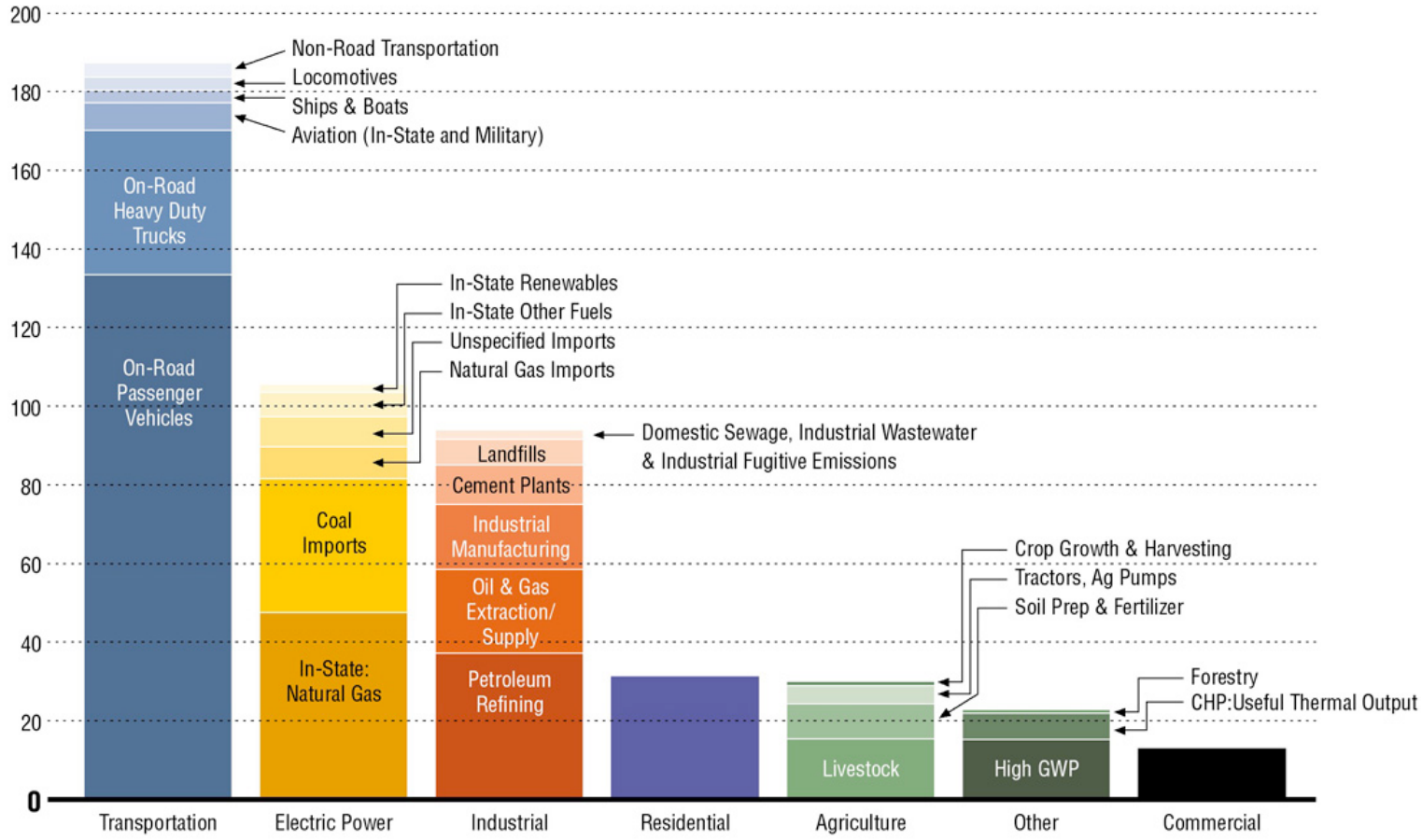


TOTAL CALIFORNIA GHG EMISSIONS

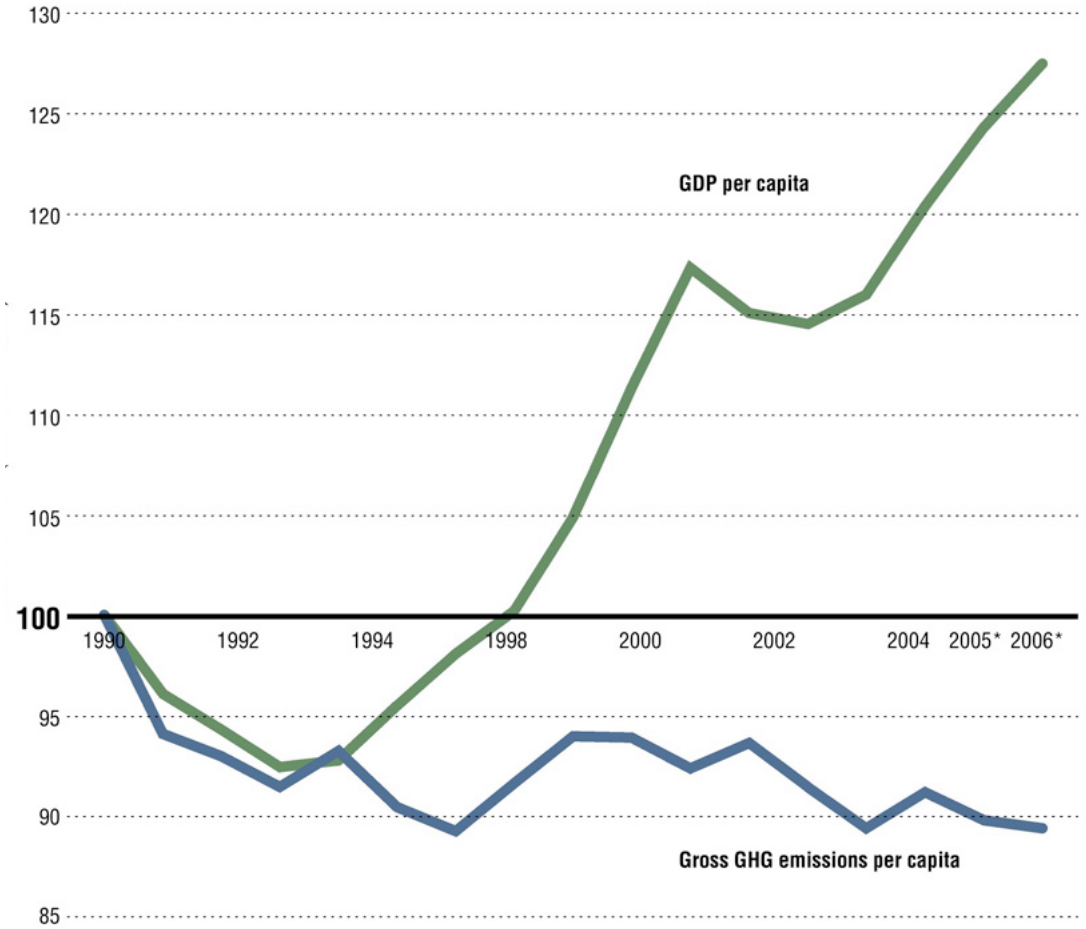


California's emissions have seen a significant increase since 1996 and a slowing rate since 2001.

GHG EMISSIONS BY DETAILED SOURCE

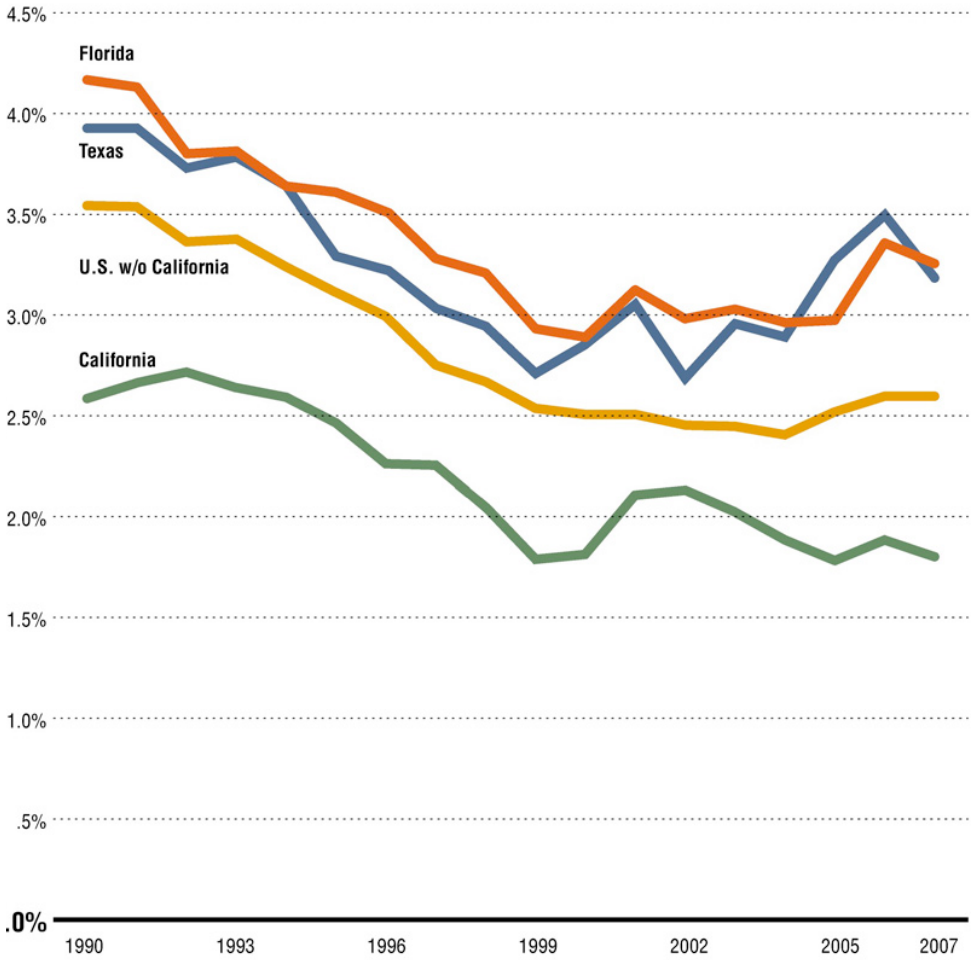


EMISSIONS AND GDP



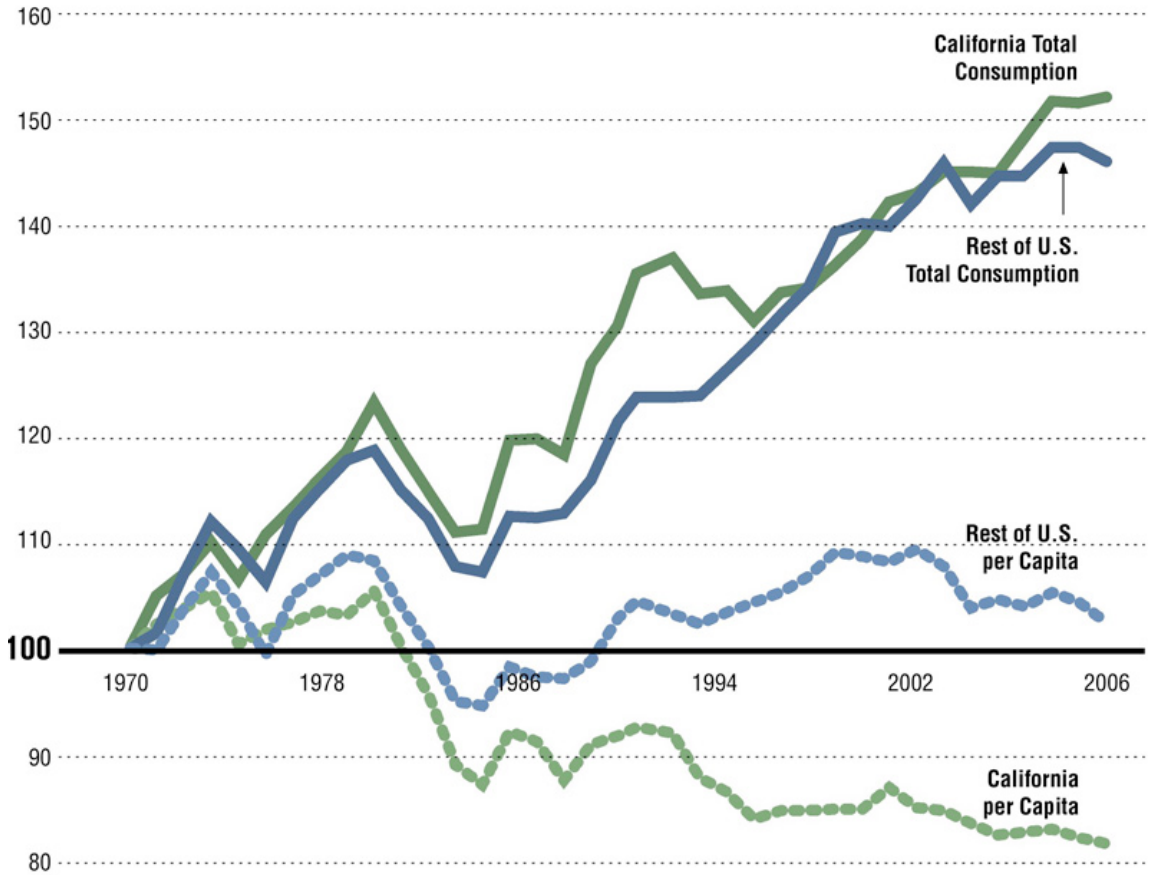
California's economic growth is increasingly less dependent on the production of greenhouse gases.

STATEWIDE ELECTRICITY BILL



California has the 5th lowest electricity bill as a fraction of GDP. CA spends half as much on electricity as Texas -- a difference of **$25 billion** each year that Californians can spend on other things.

TOTAL ENERGY CONSUMPTION

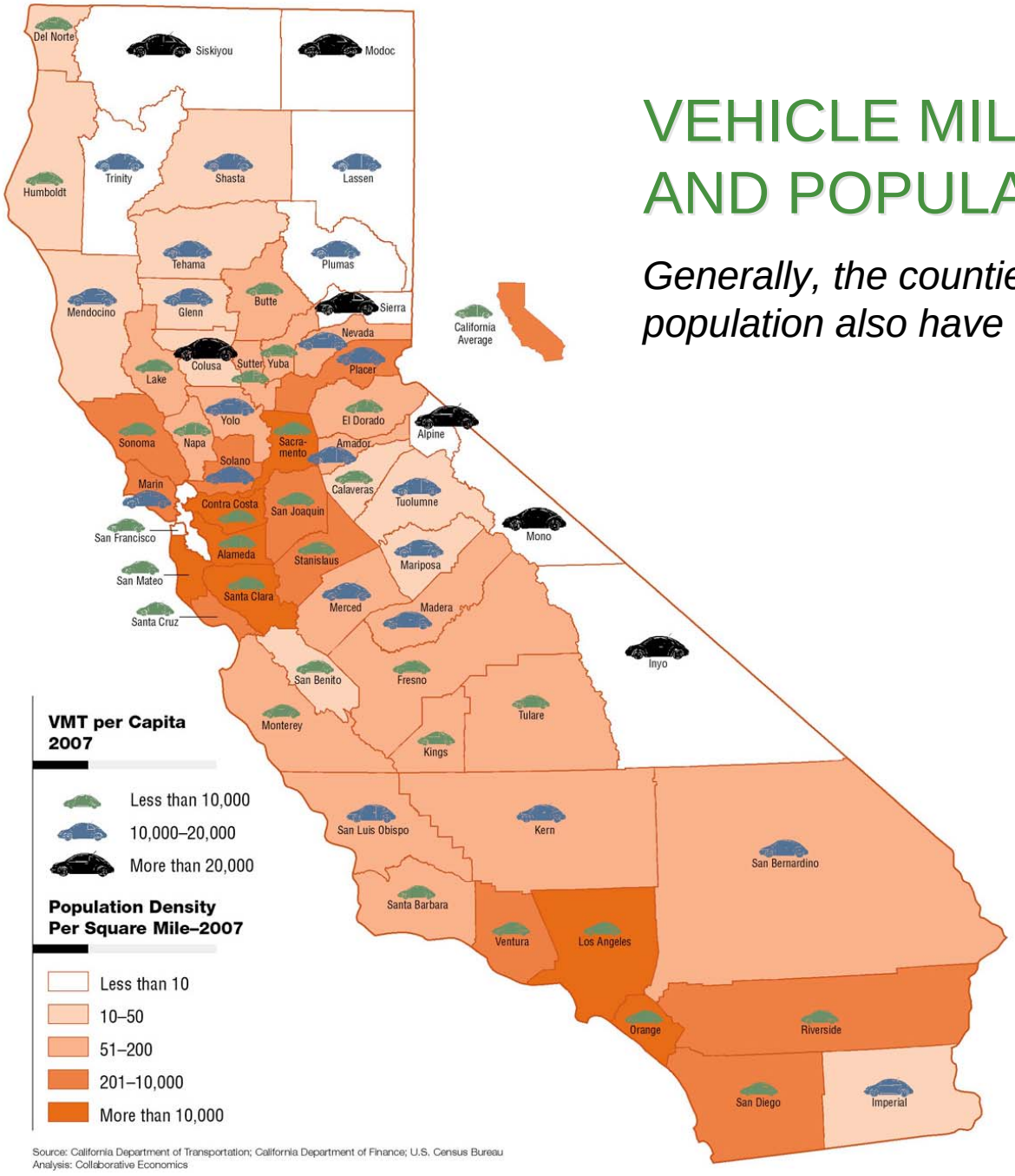


Total energy consumption in California is **50% higher** than in 1970.

Per capita, CA's consumption is **declining faster** than the rest of the US.

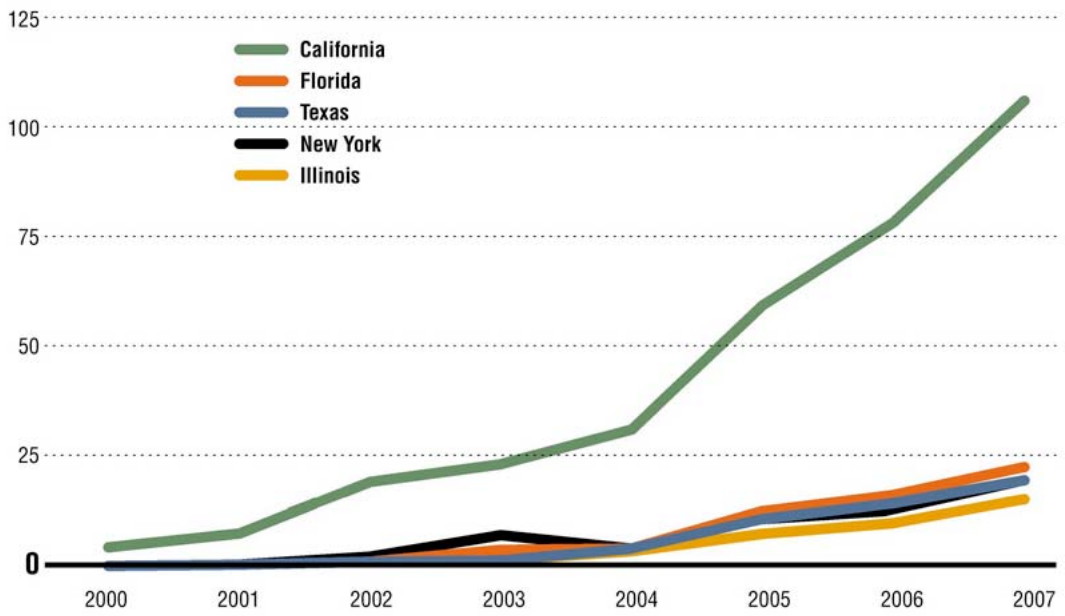
VEHICLE MILES OF TRAVEL AND POPULATION DENSITY

Generally, the counties with the highest population also have the least VMT per capita.



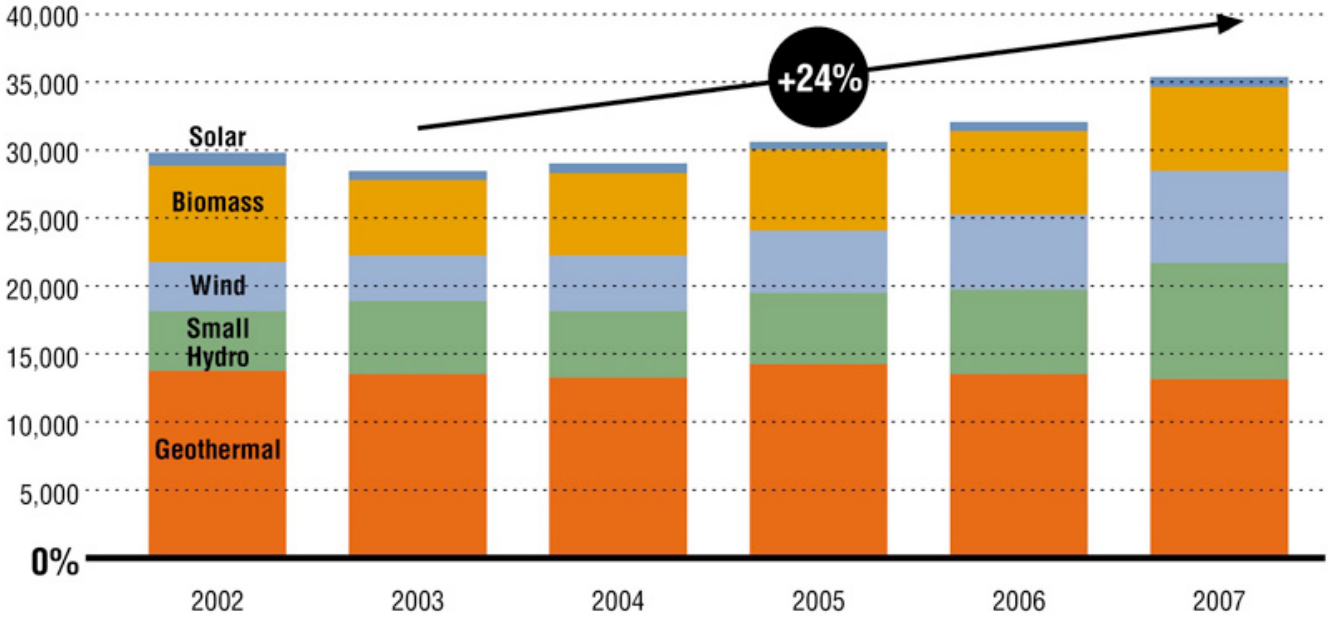
Source: California Department of Transportation; California Department of Finance; U.S. Census Bureau
Analysis: Collaborative Economics

GROWTH IN NEWLY REGISTERED ALTERNATIVE FUEL VEHICLES



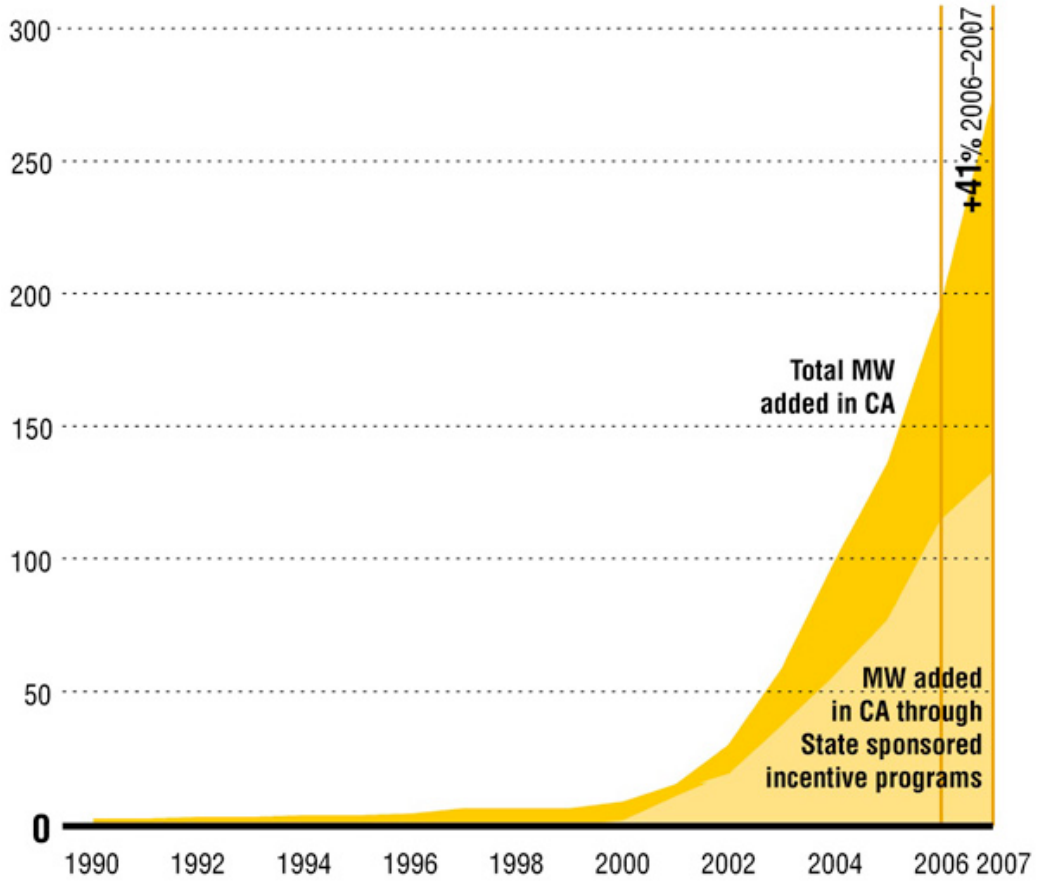
California is the top-ranking state in alternative fuel vehicle registrations, which include hybrid and electric vehicles, and vehicles that run on natural gas.

CA RENEWABLE ENERGY GENERATION



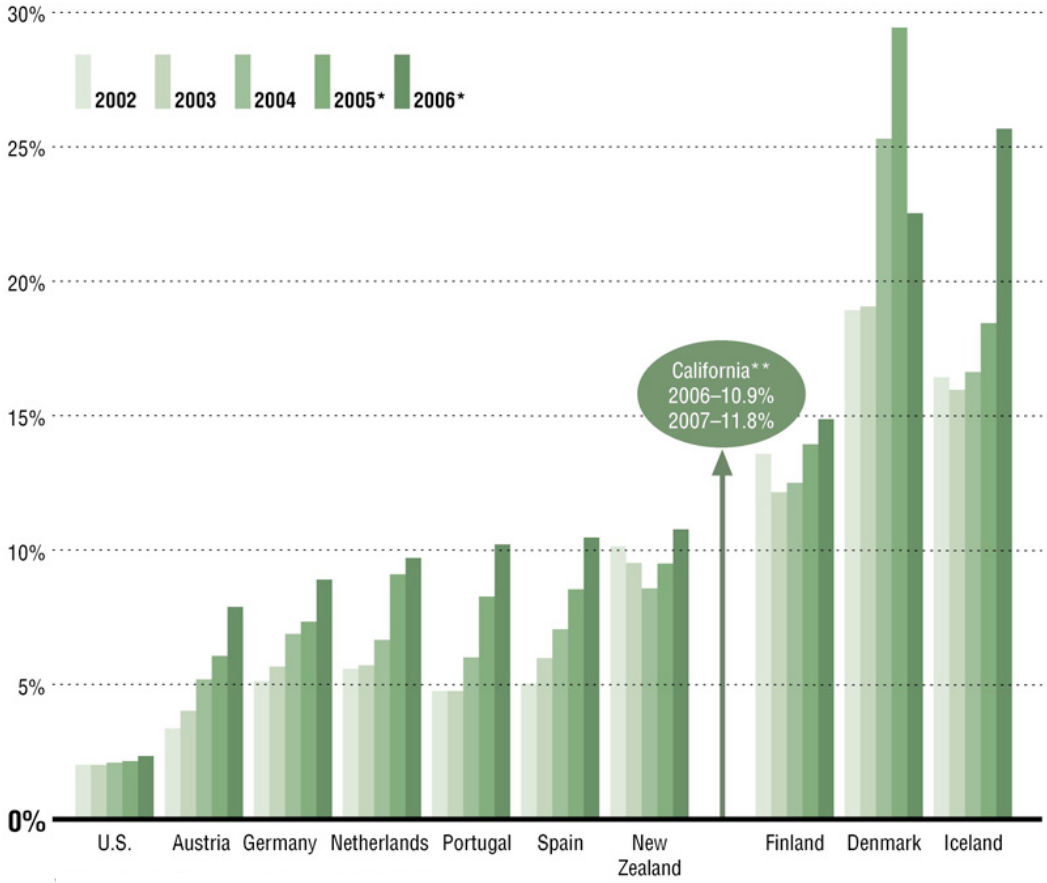
California's power generation from renewables **rose 24%** between 03-07. Nationally, California was the top ranking state for green patent registrations over this period.

ENERGY FROM SOLAR INSTALLATIONS



Electricity generated from solar installations connected to the state's electrical grid **increased by 41%** between 2006 and 2007.

RENEWABLE ENERGY GENERATION



California generates **12% of its power** from renewable energy sources, more than the rest of the US and many other top renewable energy generating countries.

Job Creation from Household Energy Efficiency									
	1972	**1977**	**1982**	**1987**	**1992**	**1997**	**2002**	**2007**	**Total**
Agriculture	—	36	112	204	266	631	849	869	2,967
EnergyRes	—	(0)	(1)	(1)	(0)	(1)	(1)	(1)	(5)
ElecPwr	—	(266)	(1,140)	(2,236)	(3,405)	(4,720)	(5,809)	(5,944)	(23,520)
OthUtl	—	(12)	(78)	(2)	13	71	77	79	149
Construction	—	—	—	—	—	—	—	—	—
Light Industr	—	821	2,688	4,593	6,095	8,392	9,247	9,463	41,300
OilRef	—	(14)	(6)	(9)	(10)	(14)	(24)	(25)	(102)
Chemica	—	48	190	448	764	555	2,234	2,287	6,526
Cement	—	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Metals	—	2	1	4	(5)	(16)	(16)	(16)	(46)
Machinery	—	14	26	54	44	(38)	(51)	(52)	(2)
Semicon	—	0	0	3	8	176	318	325	830
Vehicles	—	20	38	133	133	240	427	437	1,428
OthInd	—	37	125	265	397	1,136	1,770	1,811	5,541
WhlRetTr	—	4,740	15,254	32,236	46,139	83,118	136,402	139,587	457,475
VehSales	—	—	—	—	—	215	0	0	215
Transport	—	9	31	(211)	76	202	305	312	724
FinInsREst	—	1,191	5,340	15,075	30,808	21,500	34,201	35,000	143,114
OthPrServ	—	3,063	11,456	25,848	45,596	64,397	96,352	98,602	345,313
PubServ	—	74	3,360	22,488	56,060	98,866	148,691	152,163	481,703
TOTAL JOBS	—	9,763	37,396	98,892	182,977	274,710	424,974	434,898	1,463,611

Over the last 30 years, household energy efficiency contributed 1.5 million new fulltime jobs in California with total payrolls of **over $45 billion**.

ENERGY EFFICIENCY ECONOMIC BENEFITS

CA Air Resources Board Draft Scoping Plan:

- Achieves 100% of the AB 32 GHG emission reduction targets
- Increases GSP by $76 billion
- Creates over 403,000 climate action and efficiency jobs (increasing real household incomes by $48 billion)

CALIFORNIA CLIMATE RISK & RESPONSE

- Most Authoritative & Timely Climate Damage Science
- Translated to Seven Economic Sectors: 1) Water, 2) Energy, 3) Transportation, 4) Real Estate & Insurance, 5) Agriculture, 6) Tourism & Recreation, 7) Public Health
- Reviews Assets at Risks & Damages


THE MOST EXPENSIVE THING WE CAN DO IS NOTHING

ECONOMIC DAMAGE AND ASSET RISK ESTIMATES FOR CALIFORNIA (2006 USD billions)			
	Damage Cost/Year		Assets at Risk
	Low	High	
Water	NA	0.6	5
Energy	2.7	6.3	21
Tourism and Recreation	0.2	7.5	98
Real Estate	0.2	1.4	900 Water
	0.1	2.5	1,600 Fire
Agriculture, Forestry, Fisheries	0.3	4.3	113
Transportation	NA	NA	500
Public Health	3.8	24.0	NA
TOTAL	**7.3**	**46.6**	

“It is not the strongest of the species that survives, nor the most intelligent, but the one most responsive to change.”

-Charles Darwin